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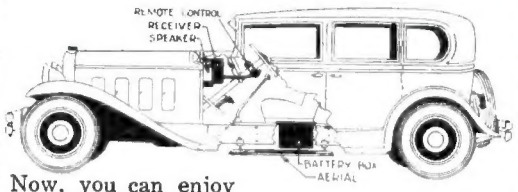

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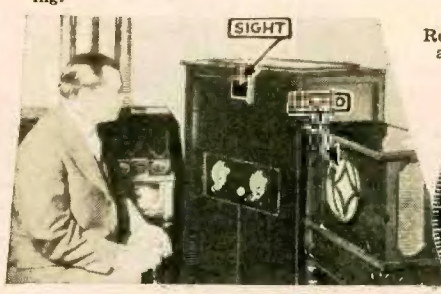

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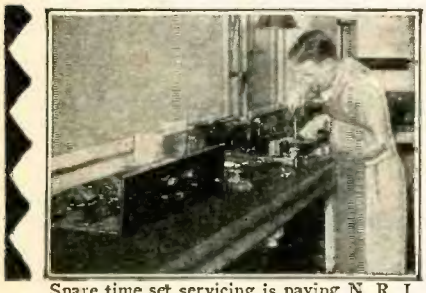

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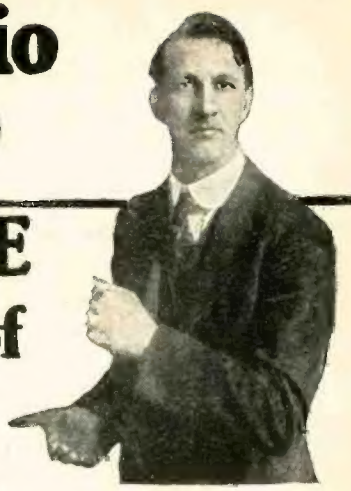

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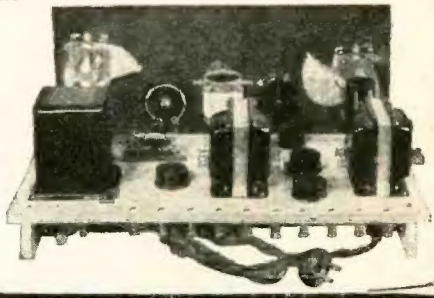

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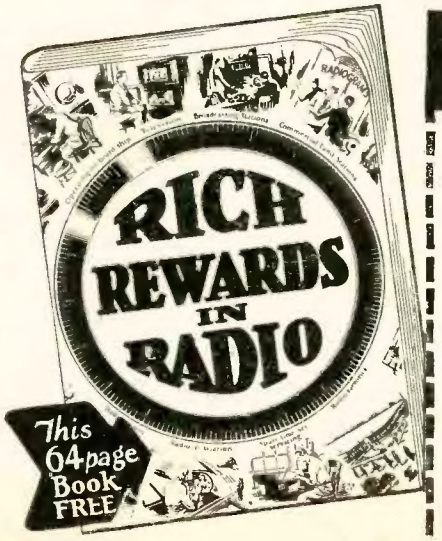

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JANUARY
1931

Science and Invention

VOL. XVIII
No. 9

TABLE OF CONTENTS

Editorial 774
Music, Noise and Noise Abatement

Flights of Fancy Come True 776

"There She Blows!" 777
William M. Roddy tells some of the thrills and facts of the whaling industry

How Hot Are the Stars? 782
George F. Paul satisfies your curiosity

Electrocuting Plant Insect Pests 783
By Joseph Farrell

Harnessing Ocean Temperatures 784
A full account of Dr. Georges Claude's experiments in Cuba

Glowworms Light These Caves 786
Amazing, but true—By Isabelle F. Story

How and Why Auto Tires Wear Out 787
If you own a car, don't miss this—By Uthai Vincent Wilcox

Amazing Partnerships of Nature 788
An interesting tale—By Gaylord Johnson

How Science Saved Our Sugar Industry 789
H. L. Kauffman explains how the U. S. government scientists turned ruin into prosperity

The Back Woods of Modern Russia 792
An astonishing tale of anachronisms—By Count A. N. Mirzaoff and Murray Godwin

Mechanical Ears 794
Modern methods of extending the range of man's sense of hearing

Butterfly Wings Are Not Varicolored 796
Dr. E. Bade proves that seeing is not believing

He Can't Miss His Train 806
Austin C. Lescarboura describes an interesting model railway

He Rides a Hundred Hobbies 809
William T. Miller tells a fascinating tale of the hobbies of the millionaire Colonel Green

General

In the Spotlight of Science 797
Eight pages of fascinating facts from here, there and everywhere

Would You Believe It? 810

You'll Have to Sprint to Get Your Share of That $3250.00 813
Final announcement of Our New Contest—Don't Miss It

The Oracle 820
Conducted by Seymour A. Davidson

The Safety Valve 826
Conducted by the Editor

Glider-Tag—the Latest Outdoor Sport 834
Doc Schnurmacher, originator of Outboard Polo, decribes the first glider game

Scientific Book Reviews 845

Index to Advertisers 862

Radio

Unscrambling the Ether 790
A. Dinsdale gives a simple explanation of the Stenode Radiostat

Television in Germany Today 807
By Dr. Alfred Gradenwitz

What's New in Radio 825

Construction, Amusement, Experiment

How to Make and Throw Boomerangs 791
By William H. Van Shrum

Spectacular Electrical Experiments 795
By John P. Morris

From Piano Stool to Book Table 805
By H. L. Weatherby, Director of Manual Training, Montgomery County Schools, Montgomery, Alabama

Model Guillotine Makes Useful Cigar Cutter 808
By Charles H. Alder

Magic 811
By Dunninger

New Ideas for the Owner and Driver 812
By Arthur George, Consulting Engineer

Make Synthetic Dyes at Home 814
By Captain Robert E. Sadtler, U. S. A.

Make Your Own Sunlamp 816
By John Steinke

For the Home Machinist 817
By George A. Luers

Try These in Your Own Workshop 818

Prize Puzzles to Polish Your Wits 819
By Sam Loyd

Making a Compact Oak Bedroom Suite 821
Part II—Bedstead and Tallboy Cabinet—By J. E. Lovett

Scientific Problems and Puzzles 822
By Ernest K. Chapin

Build This Band Saw of Laminated Wood 823
By H. O. Harris

Wrinkles and Recipes 824

Drill Press From Bottle Capper 846
By Raymond B. Wailes

Home Improvement

Scientific Aids to Your Comfort 815
By Mary Jacobs

Science and Invention's Service to Home Owners 859

For Inventors

Patent Advice 830
Conducted by Joseph H. Kraus

Yankee Brains at Work 832

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Published Monthly by
RADIO-SCIENCE PUBLICATIONS, Inc.
184-10 Jamaica Avenue, Jamaica, N. Y.

$3.50 in Canada
$4.00 in Foreign Countries

Publishers, B. A. MacKinnon and H. K. Fly; Editor, Joseph H. Kraus

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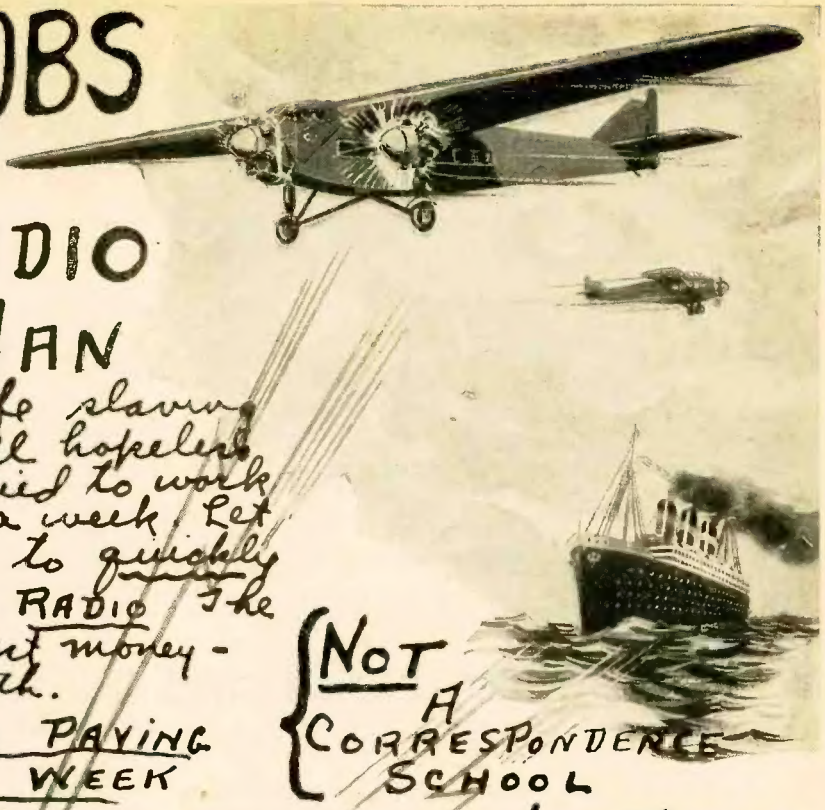

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JANUARY, 1931
WHOLE NO. 213

Science and Invention

NUMBER 9
VOLUME XVIII

Published by Radio-Science Publications, Inc., 381 Fourth Ave., New York City, N. Y.
B. A. MACKINNON and H. K. FLY, Publishers

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Editorial

Music, Noise and Noise Abatement

JUST exactly what is noise, what is music, and where is the line of demarcation?

According to Webster, noise is sound of any sort, whether loud or low, harsh, pleasant or melodious, specifically any sound that is without agreeable musical quality.

Music is a tone or tones having any or all of the features of rhythm, melody or consonance, or the science or art of pleasing, expressive or intelligible combination of tones.

Inasmuch as noise may be a melodious sound and music may likewise be a melodious sound, it would seem that the ear is both the presiding justice and the jury. Whether or not a successsion of noises can be called music would depend on who you are, where you live and how your ear has been taught to discriminate and differentiate.

The average individual regards modern jazz as music. Jazz pleases the ear of the majority, even though the so-called music of moaning saxophones, purposely squeaked violins and pianos in syncopated minors, produces decidedly discordant notes easily discernible by the trained ear.

This same trained ear that considers white man's operas, fantasies, nocturnes, and sonatas, the symbolization of supreme harmony, would look upon the sounds made on various musical instruments of the savage as being extremely crude and unmusical. The savage in turn cannot appreciate our mode of musical expression and the sounds are unintelligible to him.

Let us take a piece of hardwood, an inch square and eight inches long, and drop it on the table or floor. It creates a noise. If we follow this with another smaller piece it also produces noise. Now drop the third yet smaller one—still some noise. Pick all three pieces up and drop them one after another in rapid succession and we will have music—a succession of sounds that please the ear. Several such pieces produce the drummer's musical blocks. Many of them properly cut and mounted give us the instrument known as the xylophone. We thus see that from a succession of noises we can produce music.

These facts concerning noise and its twin sister music could conceivably be applied to noise abatement, as we shall presently see.

Inventors have already perfected railroad track crossings that do not allow the wheels to bump on the cross rails. Street car rails have been welded together for the purpose of eliminating clicks. Solid rubber tires have been and can be applied to wagon wheels. Airplane silencers have been developed that are thoroughly practical, and Hiram Percy Maxim has developed a window ventilator that prevents much of the noise in the street from entering the building. Dr. J. F. Newsome, of Stanford University, developed a similar product more than three years ago. Noiseless typewriters are found in most offices, and many of the conference rooms of our large organizations, as well as the rooms which house the stenographic force, are now constructed with walls and ceilings which absorb sound. This is one form of noise abatement.

From another angle—automobile horns, once noisy, are now made to give forth musical sounds instead of the honk and squawk of the horns of the previous decade. Music, then, is another effort at noise abatement.

If steel-tired wagon wheels *must* run on cobblestone roads, why do not some inventors develop a frequency changer so that the noisy clatter would assume an aural presentation of a succession of sounds pleasing to the ear? If pneumatic riveting hammers cannot be replaced by activated hydrogen, or oxyacetylene welding, why do not some inventors develop frequency changers to endow the tapping of the hammer with music-giving properties? If elevated structures, street car rails and railroad crossings are not provided with one or another of the many noise-eliminating devices that have been designed for this express purpose by the world's ever-budding inventors, why not make the necessary constitutional changes that will force the users of each noise-producing device to change its sound frequency? Surely, the resultant discord would not be much worse than some modern jazz.

Here then is a chance for inventors to cover themselves with glory. They should devise systems for converting tumults into harmony, or develop devices which will produce sounds so related to the fundamental noise of the vehicle or conveyance, as to beat with this fundamental. The resultant sound could then be brought up above audibility; our ear would no longer be aware of the din.

At any rate, this presents an interesting thought. Inventors should do the rest.—*Editor.*

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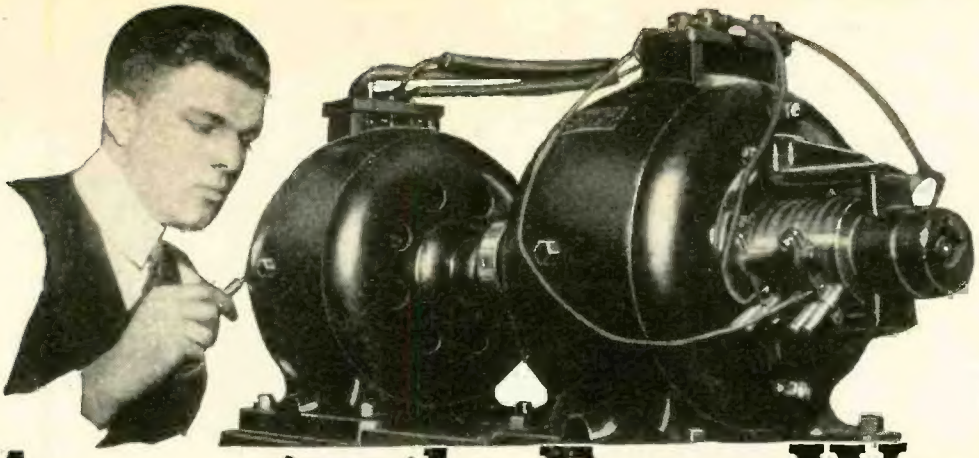

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I will allow your railroad fare to Chicago, and if you should need part-time work I'll assist you to it. Then, in 12 brief weeks, in the great roaring shops of Coyne, I train you as you never dreamed you could be trained on a gigantic outlay of electrical apparatus . . . costing hundreds of thousands of dollars . . . real dynamos, engines, power plants, autos, switchboards, transmitting stations . . . everything from door-bells to farm power and lighting . . . full-sized . . . in full operation every day!

Prepare for Jobs Like These

Here are a few of hundreds of positions open to Coyne-trained men. Our free employment bureau gives you lifetime employment service.

Armature Expert, to $100 a Wk.
Substation Operator $60 a Week and up
Auto Electrician $110 a Week
Inventor . . . . . Unlimited
Maintenance Engineer up to $150 a Week
Service Station Owner up to $200 a Week
Radio Expert up to $100 a Week

No Books-No Printed Lessons

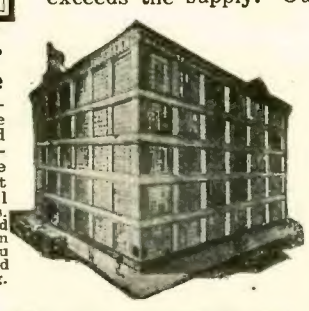
No books, no baffling charts . . . all real actual work . . . right here in the great Coyne school . . . building real batteries . . . winding real armatures, operating real motors, dynamos and generators, wiring houses, etc., etc. That's a glimpse of how we make you a master practical electrician in 90 days, teaching you far more than the average ordinary electrician ever knows and fitting you to step into jobs leading to big pay immediately after graduation. Here, in this world-famous *Parent school*—and nowhere else in the world—can you get this training!

Jobs-Pay-Future

Dont' worry about a job, Coyne training settles the job question for life. Demand for Coyne men often exceeds the supply. Our employment bureau gives you a lifetime service. Two weeks after graduation, Clyde F. Hart got a position as electrician for the Great Western Railroad at over $100 a week. That's not unusual. We can point to Coyne men making up to $600 a month. $60 a week is only the beginning of your opportunity. You can go into radio, battery, or automotive electrical business for yourself and make up to $15,000 a year.

Now in Our New Home

This is our new, fireproof, modern home wherein is installed thousands of dollars' worth of the newest and most modern Electrical Equipment of all kinds. Every comfort and convenience has been arranged to make you happy and contented during your training.



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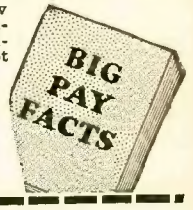

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Flights of Fancy Come True

This remarkable photograph shows two of the latest and most amazing scientific achievements of our day, two Pitcairn-Cierva autogiros flying over the new Hudson River Bridge during a recent flight over New York in search of suitable landing places within the city itself. The revolving windmill foils permit these craft to ascend and descend almost vertically.

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JANUARY, 1931
WHOLE NO. 213

Science and Invention

VOLUME XVIII
NUMBER 9

"There She Blows!"

For Hundreds of Years Man Has Hunted the Greatest of All Mammals, the Whale, the Various Products of Whose Carcase Provide a Golden Harvest for Those Who Are Willing to Experience the Thrills and Brave the Dangers so Vividly Described in This Article

By William M. Roddy

"HARD on the lee-beam, a whale; Thar she blows!" This shout of the look-out in the "crow's nest" is familiar to most everyone whether he knows anything about whales or not. And many are the stories about the pursuit and capture of this great monster of the sea—stories of hard-fought battles, of tremendous courage and of stirring adventure in far places.

Man has been hunting the whale for many centuries, even before the Pilgrim Fathers found the Indians engaged in this pastime on the coast of New England. Just who were the first people to kill and capture the whale is shrouded in the mists of antiquity—possibly they were an Oriental race. The first direct historical reference to whale hunting was made by the Norsemen in the tenth century. And though the whale dates back to Noah's time, and people are familiar, more or less, with the subject of whales, very few persons have ever seen one, and their conception of what it looks like was gained mostly from the story of Jonah and his encounter with the under-sea mammal.

Of recent years university heads, museums and biological societies have been making a concerted effort to study the life and habits of the whale; and as a result, while many important and interesting facts are known, there is much that is still held in the realm of romance and conjecture. The whale is the largest creature that lives or ever did live (the record specimen ever actually measured was 115 feet in length), yet one of the least known.

Harpoon gunner taking aim at a pair of whales as they came to the surface to blow. It was a comparatively simple matter to harpoon both of them.

But this much of the whale's history is known definitely. Millions of years ago it was a land animal. At some time in the ancient past this huge monster gradually adapted itself to water for the purpose of obtaining food and of escaping dangers on land. As sea water is the whale's supporting medium and an animal's size is chiefly limited only by that medium, the whale has continued to increase in size through the thousands of years, until now it is the largest animal that lives or ever inhabited the earth. It has four-fifths of the earth's surface as a hunting ground, and the buoyancy of the water to support its body.

Due to the fact that the whale adapted itself to the water, where there was an almost unlimited supply of food and plenty of space to avoid its enemies, it has survived while the great mammals of that period, such as the mastodon and dinosaur, have become extinct.

The American people are in a position to acquire more concrete knowledge of the whale and the whaling industry than the citizens of any other nation, for the history and records of the industry are right at their front door, so to speak. From 1825 to 1860 was the "golden era" of whaling in America, and New Bedford, Mass., was then the whaling capital of the world. And it still has the finest museum of its kind to be found anywhere on earth.

But much new and important knowledge of the whale is being brought to light from time to time, additional valuable facts are being constantly gathered from the many sources, and carefully recorded by the newly formed American Society of Mammalogists, of which Dr. Henry Fairfield Osborn, President of the American Museum of Natural History, is a prominent member. Already we know the whale is a warm-blooded creature. It breathes air

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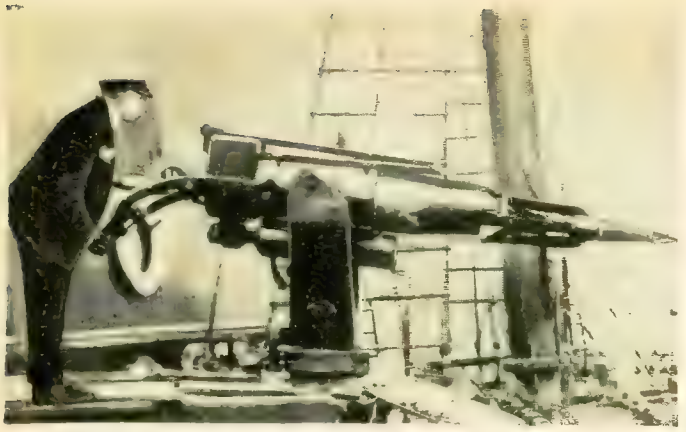

A harpoon gun, loaded with a modern harpoon with fluke-expanding bomb in the tip. The range is 40 to 60 yards.

A modern harpoon before firing; flukes closed.

and gives birth to its young and nurses them afterward for six or seven months, and the mother's milk is about the color and consistency of ordinary condensed milk. The baby whale is from 15 to 25 feet at birth and grows very rapidly the first year; it more than doubles its length by the time it is weaned, and at the age of two or three years it is able to bear young. After that one can look at a whale and say it is a young whale or an old whale, but no one can correctly state its age.

Capt. David G. Dedrick, former Norwegian sailing master and now a ranking officer of the Pacific Whaling Company fleet of killer boats, laments the fact that the romance which he found in old time whaling has largely disappeared. He insists that there is plenty of danger even today, and he should know because he has served not only on modern steam turbine-driven craft that have the latest mechanical equipment for handling of the whale, but also on the old-fashioned whaling vessels which preceded the modern whalers. Capt. Dedrick was prevailed upon to recount one of his experiences with a monster—to give his own version of one of the occasions when he was knocked out of a whale boat and wounded. He has lived through similar experiences not once but dozens of times. This story was culled from him with difficulty, the sturdy captain being very modest.

"Some years ago when I was in command of an expedition in the Antarctic waters, I took charge of one of the *killer* boats, a vessel about 25 feet long that was manned by a crew of eight oarsmen, a helmsman and myself as a harpooner Each of the eight oarsmen had an oar apiece. We set out for a day's work. Late that afternoon we sighted a school of whales, a few points off to starboard. We proceeded cautiously. Caution is needed in approaching whales because, despite their hulk, whales are very delicately attuned and seem to sense the presence of an enemy. Whales, as every one knows, usually travel in a straight line. So when you once get on their track even though they might *sound* (a term referring to a whale going down to the bottom) you can continue to row ahead knowing that you will again be on the whale's trail when he reaches the surface.

"We finally came up in back of a large beauty. I was standing on the platform of the little whale boat with the harpoon poised in my arm, my muscles tense, awaiting the moment when I should thrust the harpoon into the whale's body. The oarsmen were pulling slowly, methodically, creating as little noise as possible. We were gradually drawing up on the monster to a point of better vantage. I continued to repeat, in time with the movements of the oar, 'a little nearer —a little nearer.' The whale evidently sensed danger. He started to dive, but I was not anxious to let him get away as easily as that. With all the strength that I could command, I drove the harpoon forward, but it failed to reach 'the life.' It failed to hit the vital spot.

"When a harpooned whale does not come to the surface spouting blood, prepare for trouble.

"I knew that we were in for it. My hand instinctively went to a knife that a whaler always carries in his belt. This knife has an 8 or 10-inch blade and it is whetted to a razor sharpness. It is intended for emergency use in case it becomes necessary to cut the line, and when that occasion arises you must have a sharp knife that will cut through a three-inch hawser with one swipe. That knife may be the only thing that separates you and the others in the

When gun and camera synchronized. Note flying wads which packed the firing charge, and sparks at lower left.

Photo courtesy Dr. Roy Chapman Andrews and Am. Museum of Nat. Hist., N. Y.

A wonderful photograph of the harpoon striking a whale, showing the explosion of the harpoon bomb on impact.

A harpooned whale in the act of sounding. This is where the thrill and danger of whaling starts.

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The bent shaft and opened flukes after firing.

boat with you from the path to eternity. In this case, the knife did not do any good. I never had a chance to use it. The harpoon had entered several feet too far back of the shoulder to reach the heart. Infuriated, the whale tore off at express train speed, pulling our boat along so fast that it gave an imitation of a Gar Wood speedboat in an important race. Up one roller we went, down another, slapping the waves and spattering the spray for yards on each side, leaving a wake like a battleship—a terrific ocean sleigh-ride with a whale weighing 70 tons which had the ocean for a battle ground.

"A whale has the added advantage of being able to fight on the surface or transfer the action to the lower depths, the additional use of the flukes and flippers, the ability to hide from the enemy, and a tail weighing several tons composed of oily gristle as hard as a harbor wall which, when it spanks an object, will render that object *hors de combat* be it a ship, whaleboat or man.

"Five or ten minutes later, (it seemed like hours rather than minutes) the line slacked. The monster had tired but was still at the bottom out of sight, his whereabouts unknown. We took up some of the slack but we got suspicious, the more slack we took in the more ominous the silence of the whale became. It was nerve-wracking. We did not mind battling the monster, but we would have liked to have seen him. We would have liked to have been prepared for whatever movement he might make next. We waited, carried on a whispered conversation, and moved our boat into what we hoped might be a position of advantage. When next we saw brother whale, he boomed his battle cry.

"There was a ripple on the surface of the sea, followed by an undulating motion of our boat. Suddenly about 400 feet off our port bow, the gigantic monster 'breached.' That is something you very seldom see a whale do. 'Breaching' is the act of jumping from the sea 20 or more feet in the air and falling back on the surface flattened out. The sound made can be heard for miles, the water on each side of the whale cascades like Niagara Falls. This signal is thought to be the whale's warning to the family that trouble is abroad. At the same time, it was a signal to us of a coming onslaught. The cascades filled our boat with water.

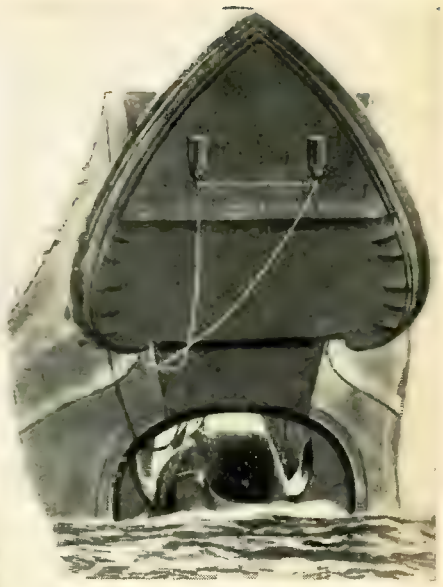
"The gods favored us again, the mammal sounded. We bailed and bailed frantically, probably hurling as much of the water into our boat again as into the sea, in our anxiety to dump it overboard and then—that dread silence on the part of Mr. Whale which seemed to paralyze our muscles.

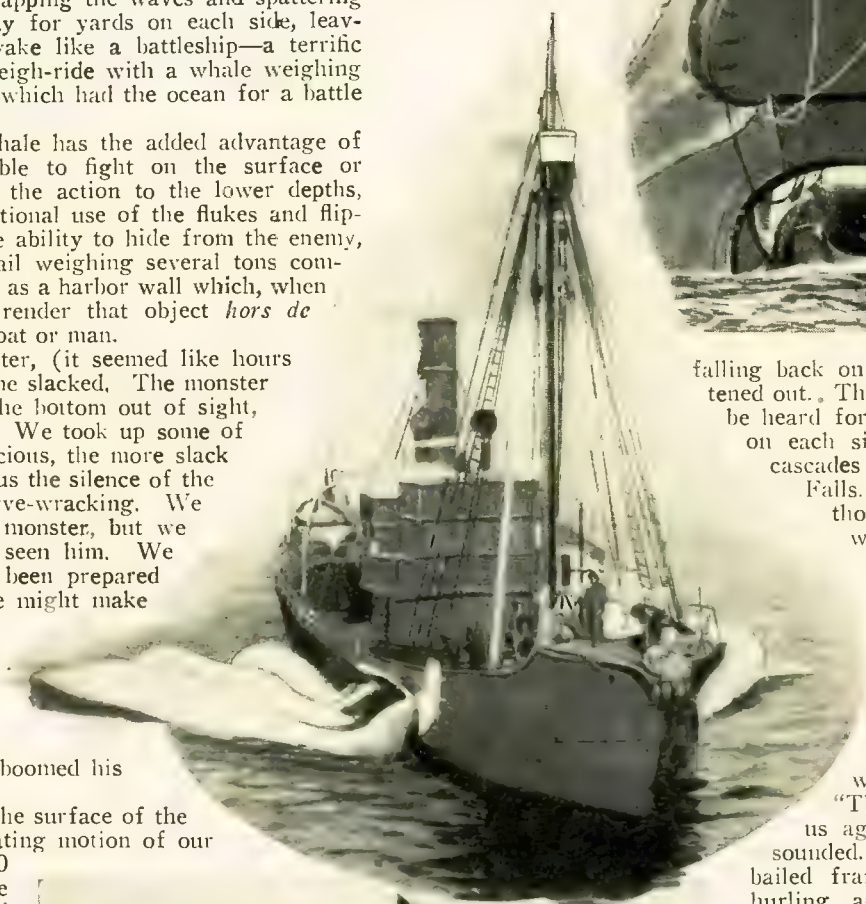
"When the boat had been made seaworthy, a glance at the white faces of the crew gave mute testimony of their trepidation. Again we hauled in the slack line, more of it than the last time. We knew the old boy was in our vicinity, fearfully close, but we did not expect him to be as close as he really was.

"All at once what seemed to be a floating island upheaved our boat. The air and the sea were in a turmoil. There was the crunching of splintered wood, the cries of sailors as they either leaped or were thrown overboard, and the twanging of the line as it swiped me a terrific broadside blow. The action of the whale had fouled this line and, being in the bow of the boat, I was caught in a bad position. The blow knocked me down and hurled me through the air and I hit the sea all straddled out forty feet away. Only Providence prevented me from being cut in half by the line that had wrapped itself about my body. I do not to this day remember how I came out of that encounter alive.

"Three months later my broken leg and two fractured ribs had healed sufficiently to enable me to leave the hospital.

Right—The capacious maw of the factory ship. Carcasses are drawn up a runway and then cut up as explained in the text. Below—At the end of the day's hunting, flag-marked whales are collected.





Above—After the whale has been killed, its stomach is inflated by compressed air so that it will float. It is then marked with the company's flag and left till the end of the day's hunting.

Left—When a harpooned whale comes to the surface after a deep "scund" and spouts blood, it is a sure sign that the animal has been mortally wounded.

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"Had I been able to cut that line, we would have saved our boat and I would have saved my ribs and legs. As it was, we lost the whale, harpoon and boat in this encounter with Moby Dick.

"Today, in the 20,000 ton steamer with all the comforts of home, with killer boats equipped with harpoon guns, much of the danger has been removed from whaling. In those days, the strength of a man's good right arm and an accurate plunge of the harpoon were the only things that stood between him and eternity."

Today whaling is carried out by fast little steamers, turbine driven and not motor driven as many believe, for a quiet approach to the whale is necessary. Water is an excellent conductor of sound and the whale has extraordinarily good hearing. Ordinary sounds of the sea do not disturb him, but the sound of a human voice, the "put, put" of a motor, or the clang of a hammer falling on the deck of a vessel, starts him for the bottom of the sea, in a panicky condition.

These little steamers of one hundred or a hundred and fifty tons, each carry a harpoon gun in the bow. The harpoon, invented in 1867 by Sven Foyn, which is still in use today, weighs about one hundred and thirty-five pounds and consists of a tough steel shank about five feet in length, carrying four 12-inch barbs hinged around the forward end tipped with a cast iron bomb loaded with black powder. The bomb is exploded inside the whale by a percussion cap timed to explode one second after striking, the barbs fly open in the cavity caused by explosion.

The cannon which fires this harpoon is mounted in the bow of the boat and has a range of forty to sixty yards. The adoption of this new method of whaling with its greater speed and less danger, coupled with the opening up in the Antarctic regions of the largest and richest whale fields ever discovered, marked the beginning of the modern era in the whaling industry. The Norwegians have had the Antarctic fields to themselves for several years, but now the rush is on and the American whalers are preparing to invade the fertile regions in force, as are the English, Japs, and other nations.

The old time American whaling vessels were from two hundred to five hundred tons, with four or five whale boats carried on deck, crews of about thirty men and the equipment for rendering the blubber was a brick furnace with a high chimney and huge copper cauldrons—all on the deck. It was a crude and cumbersome method as compared to the present system. The shore factories are passing, too, for it is no longer profitable to tow the catch thousands of miles to render the blubber and save the by-products. Now the modern up-to-date whaling fleet takes a huge floating factory along, a ship that is possibly of 25,000 tons, with a length of 500 or more feet. These factory ships are equipped with every conceivable mechanical and electrical device for handling whales speedily and economically. The

This is not a balloon or a bulbous growth, but the tongue of a whale, inflated to keep it afloat until the shore factory, shown in the background, is ready to deal with the monster.

California Sea Products, the most extensive whaling concern on the Pacific Coast, has already ordered two hydroplanes for observation purposes, which they expect will greatly facilitate the locating of the whale school.

A flock of "killer" boats—seven or eight generally, are sent out from the mother ship in pursuit of the cruising mammals; once they are sighted by the look-out in the "crow's-nest," the fast killer boat makes for the whale and the harpoon is sent hurtling for its body. If "the life" is found, the whale will soon spout thick blood, and it won't be long until the killer boat has the body alongside, pumping compressed air into the belly until the corrugations expand to balloon size; then the house flag is stuck into the remains and the whale is set adrift until it is time to retrieve the day's catch and tow it to the factory ship. The stern of the factory ship opens and the whale is pulled up the slip-way. Incisions are made in the blubber, which is from four to fourteen inches

Top—The capacious mouth of a whale. Men are leaning against the baleen, or whalebone.

Above—After longitudinal incisions having been made in the carcass, a long narrow strip of blubber is pulled off by means of a winch, like peeling a huge banana. Then a second strip is pulled off, as shown in lower picture, and so on till the entire carcass has been stripped.

Right—The strips of blubber are then cut up and conveyed to the refinery.

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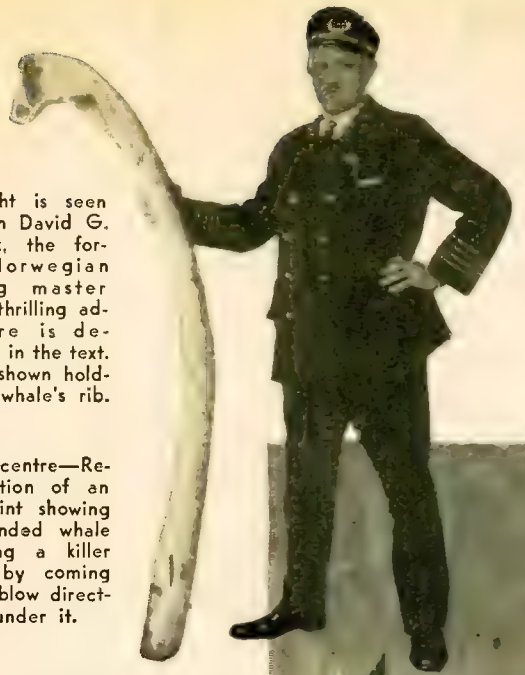


At right is seen Captain David G. Dedrick, the former Norwegian sailing master whose thrilling adventure is described in the text. He is shown holding a whale's rib.

Right centre—Reproduction of an old print showing a wounded whale wrecking a killer boat, by coming up to blow directly under it.

thick, and covered with a thin skin which peels off easily when the whale is dead. Into these incisions, hooks are fastened and the winches pull the blubber from the carcass like one would peel a banana. Into the vat it goes and then the separators refine it.

The blubber on a whale extends from the eyes to within six or eight feet of the tail. Between the end of the blubber and the tail is gristle. The blubber gets thinner and thinner as it nears the tail and head. The thickest part is around the shoulders —or the thickest part of the whale. There it is from 12 to eighteen inches thick.

The muscle meat immediately under the blubber is dark red and coarse of grain and lies under the blubber. It is as thick as the blubber and more, so some say. Under the meat is the bone structure and intestines. Whalers serve some of the meat on their ships in "meat-ball" form loaded with onions, etc. The meat is boiled and ground for meal. The best whale steaks come from under the eyes. West Indians, Norwegians and the Japanese eat whale meat extensively.

The blubber is yellowish white in color and is pure grease or oil. It is cut into chunks and put into vats and boiled; it has the consistency of rubber. When being boiled the oil is dark brown and thick and gives forth a disagreeable odor. The oil that comes from a sperm whale's head (dipped out with buckets) is white in color and not as thick as oil from blubber.

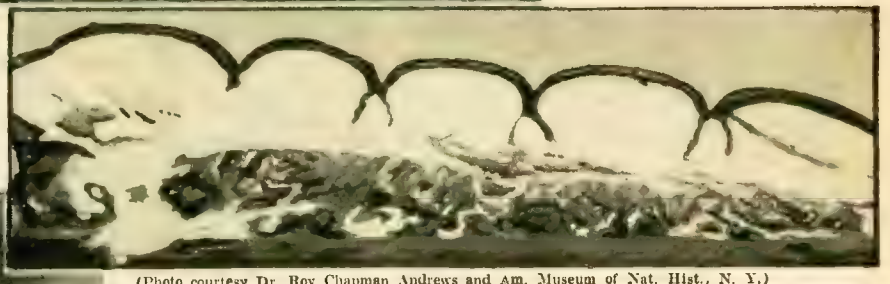
There is no refuse or cracklings to blubber itself but any cracklings that result from the rendering is from the skin, which goes into the pot with the blubber.

Whale oil is sold by the ton or tun and is worth, at the present time, about four cents a pound.

A bowhead whale (North Atlantic) and North Pacific has been known to produce 300 barrels of oil, despite the fact that it is only 50 to 55 feet in length and one third of its body is head.

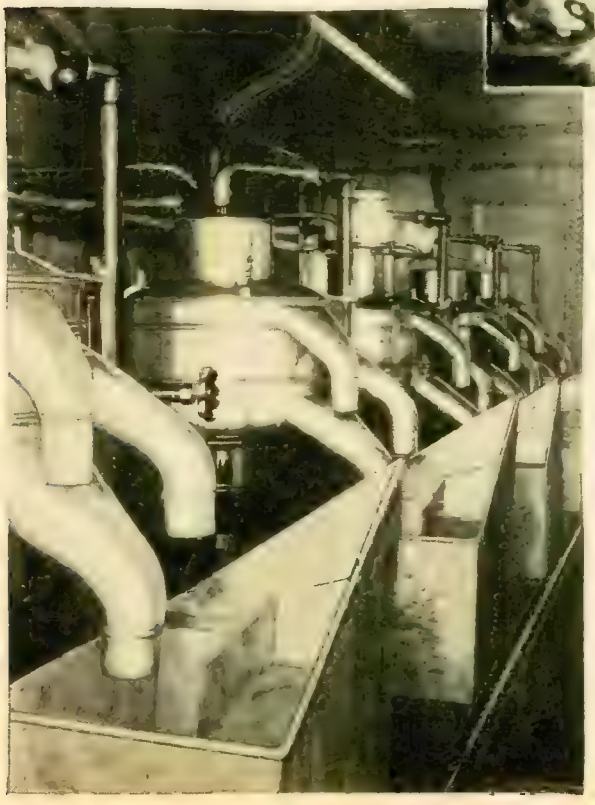
Originally, whales were hunted for oil and whalebone only, but today the entire carcass of the whale is utilized as there is a market for every part of the body, just as there is for the hog.

A big factory ship operating today can easily handle 14 whales a day and in that



(Photo courtesy Dr. Roy Chapman Andrews and Am. Museum of Nat. Hist., N. Y.)

Above—A cross section of the folds on the breast of a humpback whale. The upper thin black margin is the skin, then comes the thick white blubber, below which is the red meat. Left—A blubber refining plant on board a factory ship.



case it ought to garner 1400 barrels of oil and several tons of whale meat and other salable by-products. The Antarctic whale is nearly twice as valuable as the California whale, for it produces a better grade of oil. Generally speaking the whale should produce about 100 barrels of oil and at the present market price it would be worth from 35c to 40c a gallon. This oil, like cocoanut, sardine and other oils is away down in price, though there is a steady demand for it. It is the competition of other oils that holds the price down, and not because it has been supplanted by an oil of better or cheaper grade.

At no time since whale oil took its place among commercial commodities, has it had a more varied usage than at the present time; today it is being used in the manufacture of good soaps, paints, the dressing of leather, butter substitutes, the better grade of certain cosmetics; it is also extensively used in the tempering of steel and as a lubricant for all types of metals and machinery, and some European countries use it as edible oil. The oil of the sperm whale is classed as liquid wax rather than oil, and this is used in some of the more expensive cold creams.

In Japan and Norway, whale meat is used as food. Whale meat is also converted into meal after being cooked; fertilizer, cattle feed, chicken feed, and the bleaching of certain sugars from charcoal are made from the bones of whales. (*Continued on page* 838)

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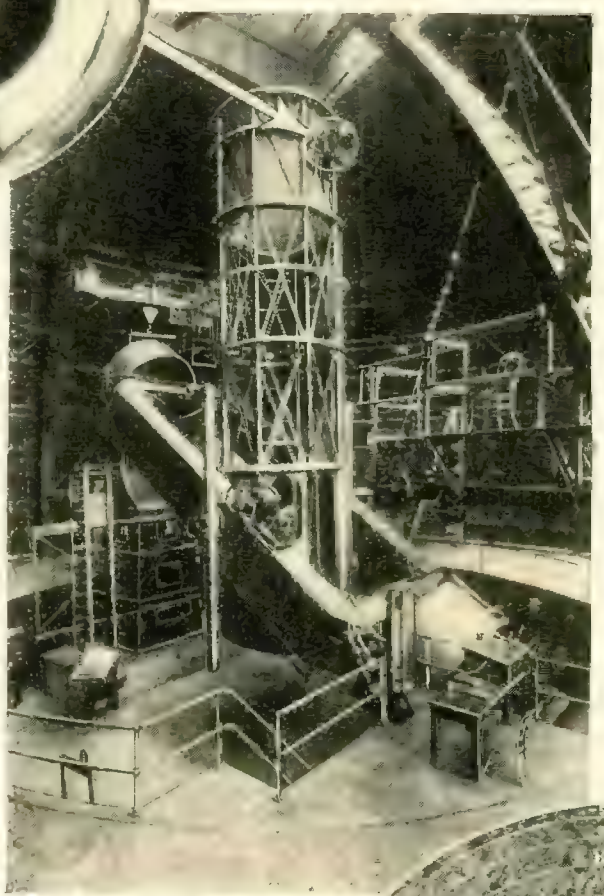
How Hot Are the Stars?

With the Thermocouple, Whose Essential Parts Weigh About as Much as One One-Thousandth Part of a Drop of Water, Astronomers Have Been Able to Measure the Heat Radiated by Stars and Ascertain the Temperature of the Planets

By George F. Paul

Looking at a thermocouple (much enlarged). Note the two metal discs and the thin wires upon which heat rays are focused.



THINK of an instrument so sensitive that is can detect the exact heat of a candle 100 miles away, under the proper conditions. Such a device, the thermocouple, is now used at Mount Wilson Observatory to measure the heat of stars and planets.

With this instrument mounted upon the 100-inch telescope, the most powerful telescope yet constructed, investigators have accomplished the astonishing feat of measuring the heat radiation of a star of the thirteenth magnitude. Stars just visible to the naked eye are of the sixth magnitude; the faintest stars photographed with the 100-inch telescope at Mount Wilson are of the twenty-first magnitude. A star of the thirteenth magnitude is about 631 times fainter than the faintest star that most of us can see, yet this delicate instrument responds to the heat focused on it from such a star

A star of the sixth magnitude, that is, one which can barely be seen, radiates upon the whole United States no more heat than the sun radiates upon one square yard of surface. The thermocouple shows that the increase in heat which this star occasions is one-half of one-millionth of a degree Fahrenheit, and that the electric current generated by it is about one twenty-billionth of an ampere. (The light in an ordinary incandescent house light is produced by a current flowing through it of from one-fourth to one ampere.) The current in the circuit connected to the thermocouple is due to the heat acting on the junction or junctions of dissimilar conductors. A current from an outside source passing through the junction in the same direction as that due to the heating of the junction, would operate to cool the thermocouple junction quite satisfactorily.

The 100-inch Mt. Wilson Observatory telescope, with its thermocouple attachment. With it observers have found that the surface temperatures of stars range from 2,800° Fahrenheit to 41,000°.

The extreme sensitiveness of the thermocouple is again illustrated in the case of the stars as they rise above the horizon. The higher they ascend the brighter they appear to grow, because the higher they rise the less of the earth's atmosphere their rays are obliged to penetrate, and consequently the less their rays are absorbed. With bright stars near the horizon the thermocouple can detect the change in brightness which takes place in one minute of time.

The principle of the thermocouple is simple. Two wires of different metals, iron and copper for instance, are welded together at their ends. The free ends are connected to the terminals of a highly sensitive galvanometer. The galvanometer thus forms part of a complete electric circuit. When the junction of the dissimilar metals is heated an electric current is set up. There are a number of thermo-electric junctions in the instrument.

Small thin metal plates are fused over the junctions of the wires and painted black. They absorb all the radiation from heavenly bodies and convert it into heat. The thermocouple is operated within a vacuum to reduce the loss of

(*Continued on page* 833)

Estimates of temperature at various regions of the moon. Because of the lack of atmosphere there, the temperature changes readily. It fell 300° during an eclipse.

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Electrocuting Plant Insect Pests

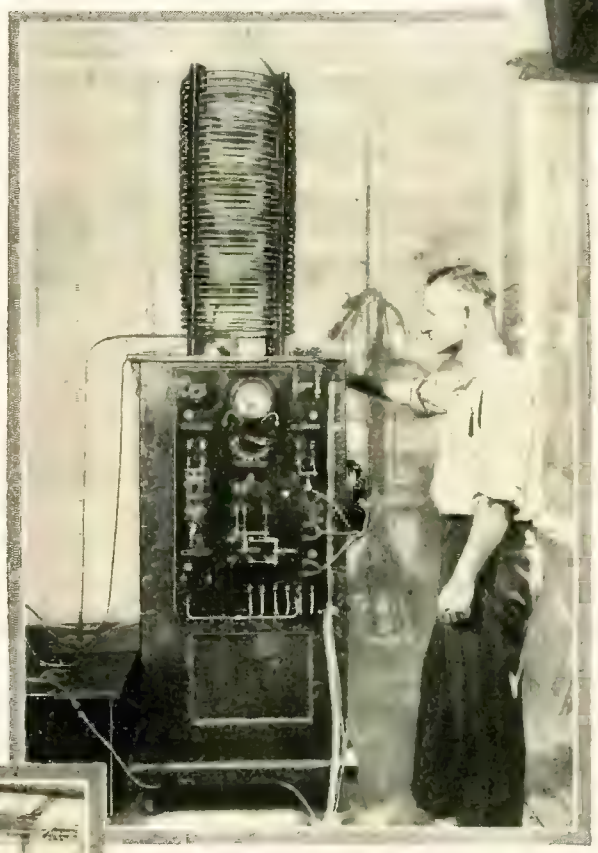
Plant Growth Is Tremendously Stimulated and Orchard Pests Are Being Eliminated at One-Tenth the Usual Cost, by Spraying with Electricity

By Joseph Farrell

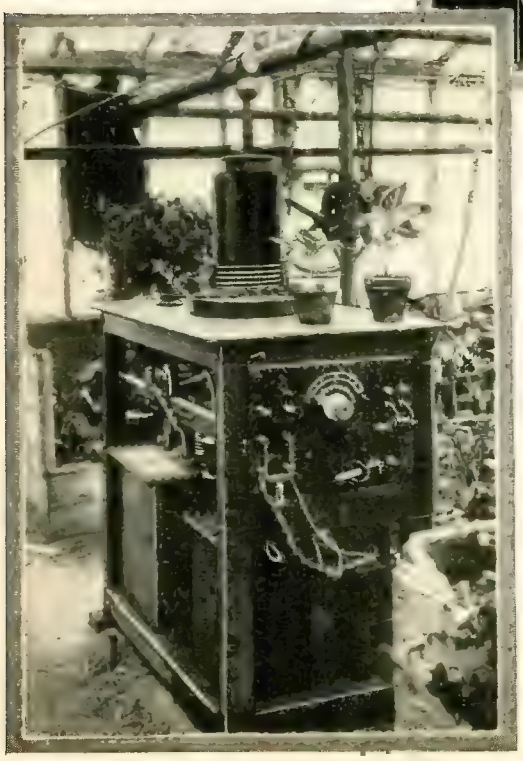
SPRAYING crops with electricity to kill insects and stimulate plant growth is being demonstrated on a commercial scale in orchards and greenhouses in the northwestern fruit region. This unusual treatment rids orchards of pests at a cost of $6.30 an acre, compared to $63.00 per acre with the more cumbersome poison spray rig. The latter method frequently leaves a residue of lead arsenate on the fruit.

When I saw the apparatus in action, tests were being made in a 2¼-acre orchard near Wenatchee, Washington. The apparatus was a three-kilowatt high-tension high-frequency outfit (250,000 volts), attached to two feeders running along the sides of the orchard. Networks of two wires were spread over each row of trees. Bare tinned copper laterals were attached at intervals of 22 feet. Upon them the wires rested.

Bean plants of the same age. The one to the left was grown under normal conditions; the other was subjected to fourteen five-minute electrical treatments.



A smaller model for greenhouse use. The Begonia plant on top of it, to the left, was grown naturally; the one to the right received electrical treatments.



To generate electricity, this three kilowatt 250,000 volt outfit is used. From it, two feeders carry the current along the sides of the orchard; it is distributed over the trees from a network of wires.

The orchard was divided into parts and each part was treated for a half hour every day. There were fewer aphids in the orchard than in adjoining lands and this was attributed to the fact that the apparatus kills all eggs and larvae (but not mature moths nor hard-shelled bugs); the area contained a smaller percentage of cull fruits; the leaves were large; there was a good growth of fruit spurs, and an especially good growth of grass. The apples on the trees have remained free from pests and worms and are much larger than fruit in adjoining orchards; the cover crop, alfalfa, is hardier and larger than it ever was before.

According to Herbert S. Smith, the engineer in charge of the work, the operations are as follows:

"Electrical energy is put into the air under high voltages at high frequencies. This leaks off the wires, the wires acting as the antennae for the set. Because of the increased activity in the atmosphere, the ozones built up drive away the oxygen about the trees Stimulation in the atmosphere makes the fruit larger and the trees clean from aphids and scale."

The network of wires does not discharge sparks; it resembles the radiating antenna of a powerful transmitting station. The electrical equipment resembles the now obsolete spark radio transmitter.

A greenhouse in the same district was wired and the machine used a few minutes each day. Tests were made with begonia plants, six of the plants being placed under the wired section of the house, and six placed outside the electrical spray area. In two weeks' time the six plants that had been especially treated were found to be much larger and hardier than those grown under normal conditions.

Tomato plants in the greenhouse grew eight feet tall; turnips were harvested one month after planting and were found to be fully grown; another lot planted early in April was gathered less than six weeks later and were twelve inches in circumference; beets planted and harvested at the same time as the turnips were eight to ten inches in circumference.

In the carnation room of the greenhouse, small (*Continued on page* 839)

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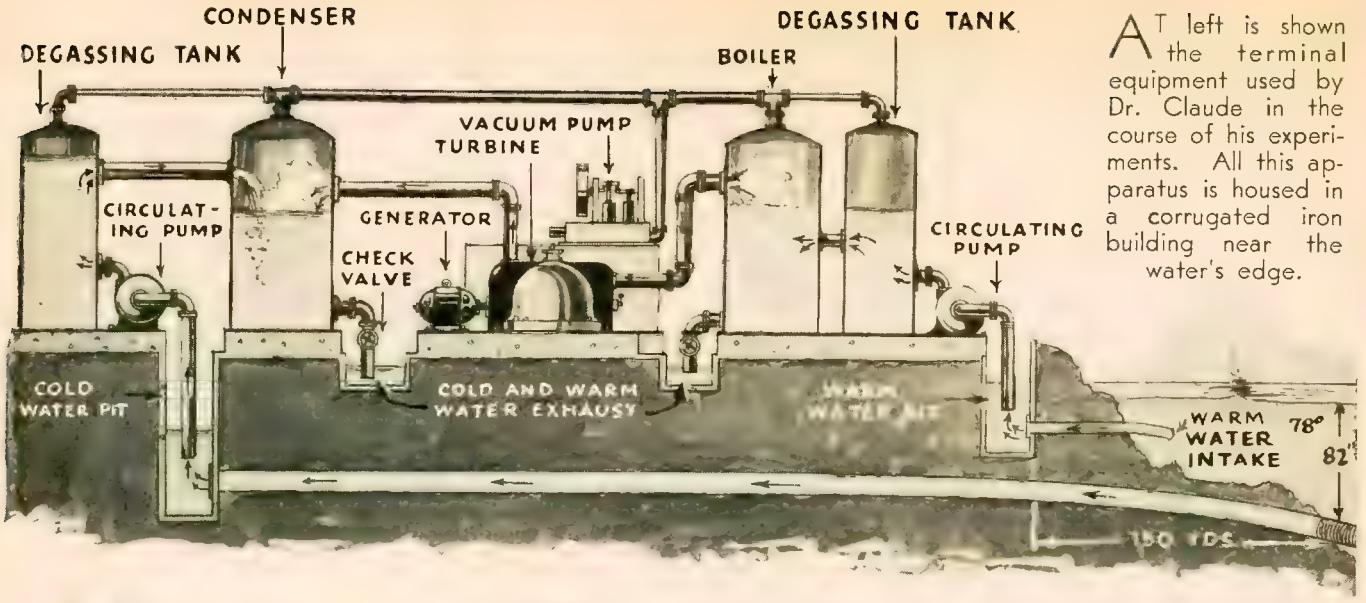

AT left is shown the terminal equipment used by Dr. Claude in the course of his experiments. All this apparatus is housed in a corrugated iron building near the water's edge.

Harnessing Ocean Temperatures

A Full Explanation of the Experiments Made by Drs. Georges Claude and P. Boucherot at Matanzas Bay, Cuba, to Generate Electrical Power by Turning to Account the Fact That There Is a Wide Difference of Temperature Between Water on the Surface and on the Floor of Tropical Oceans

THE possibility of deriving cheap and unlimited power from the ocean has long attracted the attention of inventors and scientists. The most obvious method of harnessing the potential power of the ocean is to make use of the differences in level caused by the tides. Another suggested method is to make use of the energy expended by the waves in their ceaseless pounding of tropical beaches. Both of these ideas have been experimented with, and innumerable patents have been taken out for inventions designed to harness such power, but so far complete success has not been forthcoming.

Above — Showing the final successful launching of the mile-long tube from small flat cars running down to the water's edge on a narrow gauge railway. Expert swimmers from the Cuban navy assisted in the launching. Left—The hot water purifier and the boiler in which steam is generated.

There is, however, another and less obvious source of potential energy in the sea. The real source of this energy is not the sea itself but the sun, which is continually radiating enormous quantities of energy in the form of heat. We know, because we can feel it, that the sun heats up dry land during the day, and we know, also, because we can feel it, that the surface of the sea is heated as will. We know, also, that earth and rocks heat up and cool down much more rapidly than

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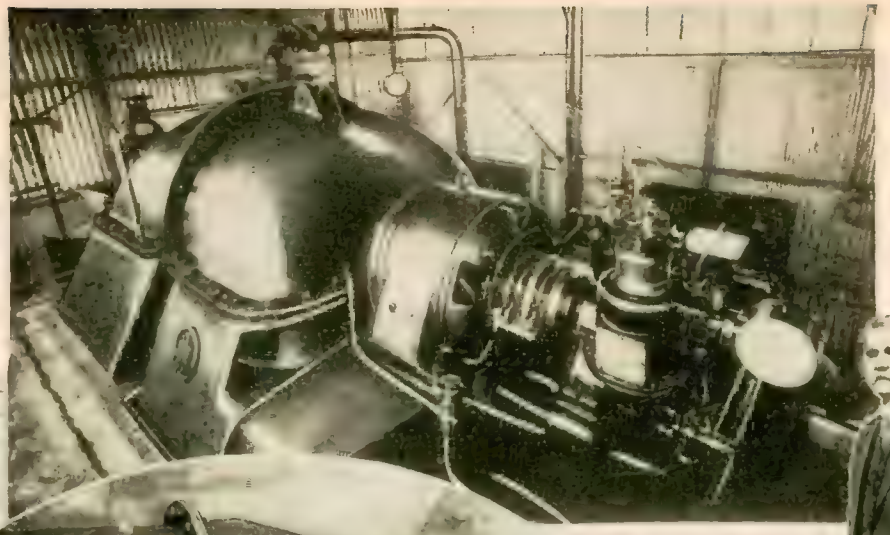
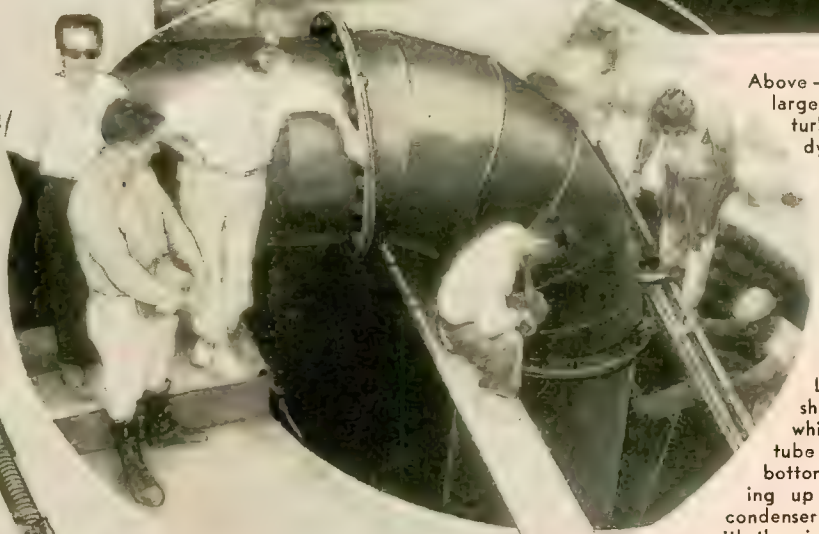
SHOWN below is the mile long tube which extends down to the bottom of the ocean, which is nearly 2000 feet deep at this point. The accordeon section enables the tube to bend easily over the cliff edge.





Above — Here is the large low pressure turbine with the dynamo coupled to it. Right — Dr. Georges Claude, already well-known as the inventor of Claude Neon Signs, processes for making synthetic ammonia, and methods of liquefying gases. Left — This photo shows the well into which the great sea tube leads from the bottom of the bay, bringing up cold water which is used in the condenser. The joint here connects the well with the circulating pump.

does the sea. Any experienced swimmer knows that if, during a hot summer, a sudden cold snap sets in for a day or two, the sea will still be warm enough to bathe in, in fact, a swimmer may often be warmer in the water than out of it.

The sea, therefore, acts as a vast store house for the heat radiated by the sun. But this heat is concentrated near the surface, which fact will also have been observed by experienced swimmers. Thus there exists a temperature gradient, or difference in temperature, between water at the surface of the ocean and water at or near the bottom, where the temperature is kept near freezing point by slow circulation from the poles. This difference in temperature is naturally greatest in the tropics.

Advantage of these facts has been taken by Drs. Georges Claude and P. Boucherot, of the French Academy of Science, in the development of their experimental power plant at Matanzas Bay, Cuba, with which a certain amount of success has recently been achieved. Briefly stated, the principle on which the Claude plant operates is as follows:

Warm surface water is fed to a "boiler" from which air is exhausted, with the result that steam at low pressure is evolved from the warm water. This low pressure steam is fed to a turbine and thence to a condenser, where it is cooled and liquefied again by contact with cold water drawn up from the ocean floor. The turbine is coupled to a dynamo which thus delivers power from the sea in the form of electrical energy.

What is perhaps not clear from the above brief explanation is how steam comes to be generated from water which is certainly not at a temperature which we associate with the boiling point of water, namely, 212° F. However, the temperature at which water (*Continued on page* 850)

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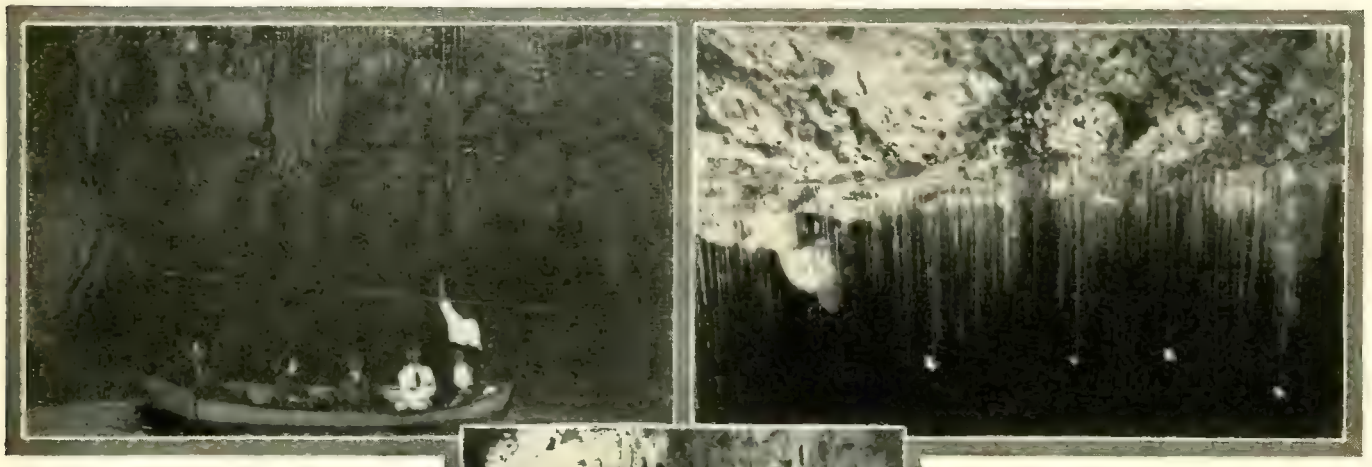
Glowworms Light These Caves

Amazing as This Article May Appear, the Editors Have Thoroughly Checked Up on the Structure and Habits of the Particular Species of Glowworm Which Is Responsible for the Phenomenon. Authenticated Descriptions of It Are to be Found in the Records of the British Museum

By Isabelle F. Story



The glowworm chamber, Waitomo Caves, North Island, New Zealand. The guide pulls the boat along.

The Menagerie, another of the Waitomo Caves.

Glowworm threads. These serve as lures for insects which are ensnared on the sticky threads.

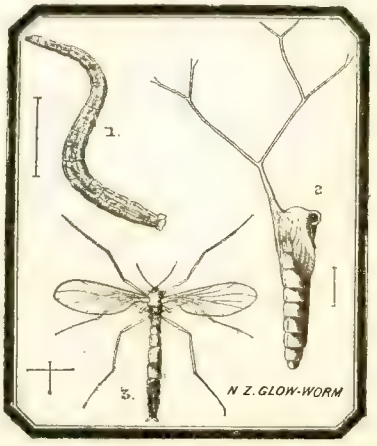
WONDERFUL strides have been made in the technic of illuminating great caves by means of flood lighting and ingeniously placed electric lights of various types. New Zealand, however, claims the most uniquely lighted cave of all. It is the Glowworm Grotto, in the Waitomo Caves.

As the name indicates, the natural means of illumination in this limestone chamber is a little insect—or, to be exact, hundreds of thousands of them—of the glowworm species. The combined light from this host of living lamps sheds a pale lustre on the snowy, slow-dripping stalactites, giving them an unearthly beauty.

All of the Waitomo Caves are entrancing, with their myriads of stalactites and stalagmites of lime and other unusual formations, their chambers studded with crystals, and their underground rivers, but all these features may be found elsewhere. The lighting of the Glowworm Grotto is unique.

The glowworm that gives its glory to this particular chamber does not resemble the ordinary glowworm of New Zealand or other parts of the world. It is a luminous, spiderlike creature, more closely related to the spider family, in fact, than to any worm species. Unlike many types of glowworms, it is carnivorous.

It is in the second, or larva, stage of life that these insects, known scientifically as *Bolitophila luminosa*, do their bit to brighten their natural surroundings. The body of the larva or grub has a skin so transparent that it is possible to see all of its internal organs. It is a fragile little thing, slimy and grey in color. When full grown it has a segmented body, no legs, and a lamp carried inside the last segment.



Three stages of the glowworm's life. (1) Larva. (2) Chrysalis or pupa, and (3) Fly.

The grub builds itself a silken sheath, placed horizontally on the ceiling of the cave and saturated with a slimy liquid. Inside this sheath or hammock it glides backwards and forwards.

Its carnivorous appetite, however, is the main cause of lighting the grotto. In order to satisfy it, the grub goes "fishing;" or, more accurately speaking, stays at home and with siren skill lures its prey. This is done by means of spun silken threads, which are covered with little globules of mucus and allowed to hang down vertically from the horizontal sheath. These threads vary in size and number. Specimens have been seen up to two feet in length, and it has been estimated that some of the larvae have had as many as fifteen to twenty threads hanging from their silken hammocks.

Since the prey of this glowworm consists of tiny insect life, it is found only in places where there is an abundance of midges and the like. The Waitomo Caves are an ideal habitat, as through them flows a subterranean stream whose banks are infested with midge grubs which live on the organic matter in the rich mud. When the grubs are transformed into tiny midges and emerge from the water, they are attracted by the (*Continued on page* 843)

Photos courtesy New Zealand Government.

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How and Why Auto Tires Wear Out

The design of a tire tread means more than an artistic expression or a handsome pattern. For it has much to do with its wear, along with wheel set, roads and other important factors, according to Government engineers who have been using a tire wear testing machine

By Uthai Vincent Wilcox

TIRES *do* wear out.

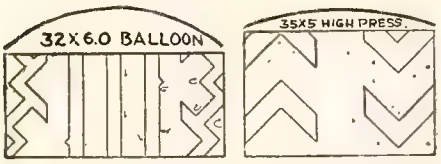
Why they wear out unevenly, become cupped, scuffed or otherwise damaged is a problem that concerns both the man who runs a car, the merchant and the manufacturer of tires.

Furthermore, when it is time to buy a new set of tires, what difference does it make whether the pattern of the tread is criss-cross, filled with buttons, longitudinal or some other combination?

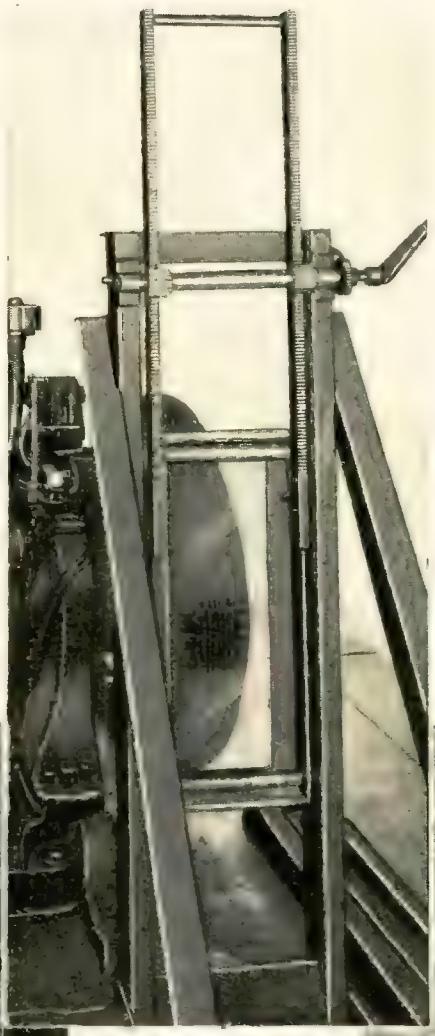
Very recently engineers and scientists of the Bureau of Standards, U. S. Department of Commerce, have investigated the wear of tires, particularly the wear on the tire treads. They have perfected unique machines that tell how and why various designs in tire treads wear faster than others. In such studies tire manufacturers have given every encouragement and cooperation.

A pneumatic tire is constructed with a thick layer of rubber around its outer circumference to act as a wearing surface. This is referred to as the tread, as distinguished from the body of the tire, which is designed to withstand air pressure. The ideal tread, in addition to giving tractive properties to the tire, should wear down uniformly, and at such a rate that it will last as long as the remainder.

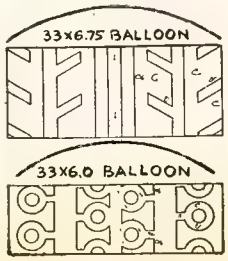
W. L. Holt and C. M. Cook of the Bureau of Standards perfected an apparatus by means of which a tire can be pressed (*Continued on page* 848)

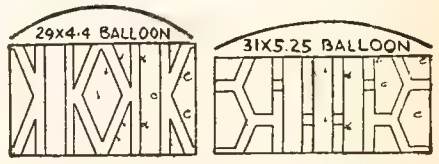


Drawirgs taken from wax records showing tread movements. A V-shaped mark on a wax plate is a common record from this part of the tread.

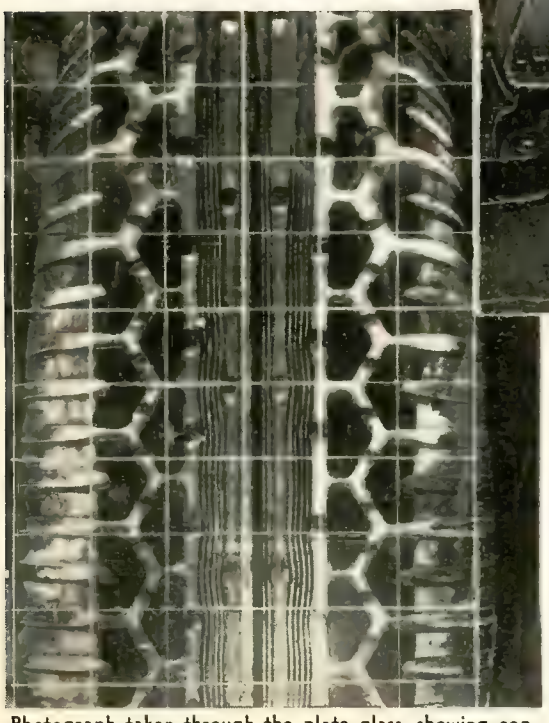


Above — Apparatus designed by the Government scientists for the study of tire tread wear. Below — Another wax record drawing. The arc above each section shows the profile of the raised portion of the tread.





The movements of the tread are different for the center, intermediate and outer portions, thus causing the curves on the straight part of the patterr.



Photograph taken through the plate glass, showing contact area of a tire under load. The depressions in the tread are painted to show contrast.

Photograph of a typical wax plate, showing tire tread movements as scratched on the wax by the carborundum dust. Note the circular twists the tread received.

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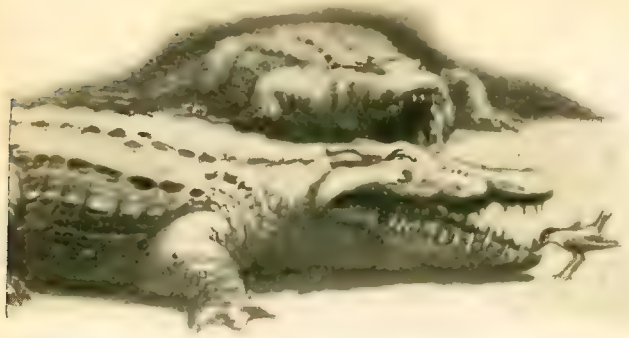

The plover bird hops into the yawning jaws of the crocodile, and picks leeches from his mouth.

The Lion and the Lamb May Not Lie Down Together. . . . But a Small Bird Steps Calmly Into the Wide-Open Mouth of the Voracious Crocodile; the Tiny Pilot Fish Swims Within the Reach of the Huge Blood-thirsty Shark; the Female Bitterling Lays Her Eggs in the Gills of the Shellfish and the Hermit Crab Uses the Sea Anemone as a Protecting Roof

Amazing Partnerships of Nature

By Gaylord Johnson

ONE of the first world-tourists was Herodotus, the Robert Ripley of Greece. He loved to record, "Believe It or Not" facts to drive the homefolks goggle-eyed with wonder. One of his best stories was that of the astonishing relationship which existed between the crocodile and the Egyptian plover. Globe-trotting Herodotus, insisted that he had seen this bird step calmly into the wide open mouth of the crocodile and pick blood-sucking leeches from the big reptile's gums.

So that his audience could not miss his point, he explained that the crocodile was never in the habit of restraining his appetite when any other living things got within reach of his quick-snapping jaws. And then, to drive his point home with a punch, he told them the bird performed another friendly service for the crocodile; it emitted shrill cries to warn him of approaching danger. And believe it or not, science has not been able to invalidate Herodotus' claim in the two thousand years which have elapsed since he lived and told his tales. Students have found that Nature presents many amazing examples which may be conscious partnerships that are almost unbelievable or mere accidents.

Certain sponges have been found to play hosts to small crustaceans of the shrimp family. Mussels of the oyster tribe give shelter within their shells to tiny crabs who do a kind of housemaid service in return. Species of ants shelter and care for the green or black plant lice or aphids, in exchange for the privilege of milking them, like cows, of the sweet plant juice they have eaten. A tiny mite habitually lives on the dorbeetle's armor and keeps it clean, with a continuous meal of dung for reward.

A station-house, gate and all, is provided for its ant police by the cow-horn orchid.

The team of shark, sucker shark, and pilot fish has been a source of wonder and amusement to sailors for centuries. Several pilot fish are sometimes seen swimming around a single shark, like motorcycle policemen escorting a municipal dignitary's automobile. And tiny sharks, called sucker sharks, attack themselves to the belly of the shark by means of a sucker-like muscular structure and hook a free ride.

Like the crocodile, the shark seems to restrain his blood-thirsty appetite and not regard his small associates as legitimate prey—while in return for this immunity the pilot fish is supposed to guide the shark to schools of mackerel and other fish entirely suitable for a shark's dinner. The pilot fish thus resembles the pointer dog of a human hunter. Of course, the pilot fish does not disdain any scraps that escape the shark's jaws, especially when it makes a meal of larger prey—such as a pearl-diving native. The pilot also secures considerable protection (through travelling in the shark's company) from being gobbled up himself by other large fish. It would seem from field and aquarium observation that the pilot fish is merely hanging around for food. It is quick enough to get out of the way of a hungry shark (*Continued on page* 854)

A shark's constant entourage consists of several small pilot fish who swim ahead of him, and the small sucker shark.

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How Science Saved Our Sugar Industry

By H. L. Kauffman

In 1926, Louisiana's Historic Cane-Sugar Industry Appeared to be Doomed, Owing to Disease. Then Science Rushed in and Saved the Situation by Discovering Disease-Resisting Sugar Canes

After reaching the tropics the expedition's airplane was fitted with pontoons so that it could alight on water. This picture was taken on a river in New Guinea 200 miles from the coast.

CAN you imagine yourself getting along without sugar? With no 5-cent candy bar to nibble on, no sugar for coffee or iced tea, no delicious chocolate caramels or creams or other sweets? Not so pleasant to think about, is it? Nor would it be pleasant to our pocketbooks if we had to pay 25 cents for a candy bar which we now get for a nickel, or five dollars for the one-dollar box of chocolates which we now take to our wife or best girl!

But perhaps you recall how you disliked having your sugar ration cut down during those World War days of 1917-'18. If so, then 'nough said!

Dr. Donald A. Laird, director of the psychological laboratory at Colgate University, has proved by actual tests that sugar in sufficient quantities is necessary to our endurance; in other words, that it gives us energy and stamina, and makes us alert and active.

Dr. Brandes inspecting sugar cane growing in a greenhouse at the Arlington farm of the United States Department of Agriculture.

These Papuan natives assisted the sugar expedition in collecting "wild" sugar canes in New Guinea.

The story of man's dependence on sweets, and by that we mean sugar, has already been told. This is the story of how science has saved the cane sugar industry for us in Louisiana, and before long will again fill Louisiana's "sugar bowl" to overflowing. And if you are like myself, one who enjoys sugar in your coffee, and a good chocolate caramel at almost any time, you'll appreciate what these government experts have done; for it means greater assurance to us that we're not going to have to pay, at least not within the immediate future, any excessive price for the sweets we like and need.

This photograph, taken in Louisiana in October, 1928, shows the stripping and cutting of a 3-row unit of heavy-yielding, upright, straight cane.

In 1911 Louisiana produced 352,874 tons of raw sugar; in 1926 production had fallen to the disheartening minimum of 47,000 tons—the lowest figure reached during the preceding half century. The situation at the close of 1926—the last season in which the State's production of sugar was made from certain long-used varieties of cane—was a desperate one and, to all appearances, Louisiana's historic cane-sugar industry was doomed. A particularly harmful plant disease, known as the mosaic disease, was rampant.

The situation was serious, affecting as it did the sugar-cane sections of Louisiana, Mississippi, Alabama, southwestern Georgia, and northwestern Florida. That the industry was not destroyed completely was only due to the activity of scientists in discovering that the malady was being spread by a tiny insect carrier; and after long search in foreign lands, the finding of strains of sugar cane especially resistant to the disease. Further research work also resulted in the development of other resistant strains by cultivation, and the production of canes that can reach their maturity within a wider climatic range than was possible with the kinds of canes formerly planted.

As far back as 1919 the government experts had been aware of circumstances that most of the sugar planters of Louisiana had overlooked. At that time Dr. W. E. Brandes, principal pathologist in charge of the office of sugar plants of the United States Department of (*Continued on page* 836)

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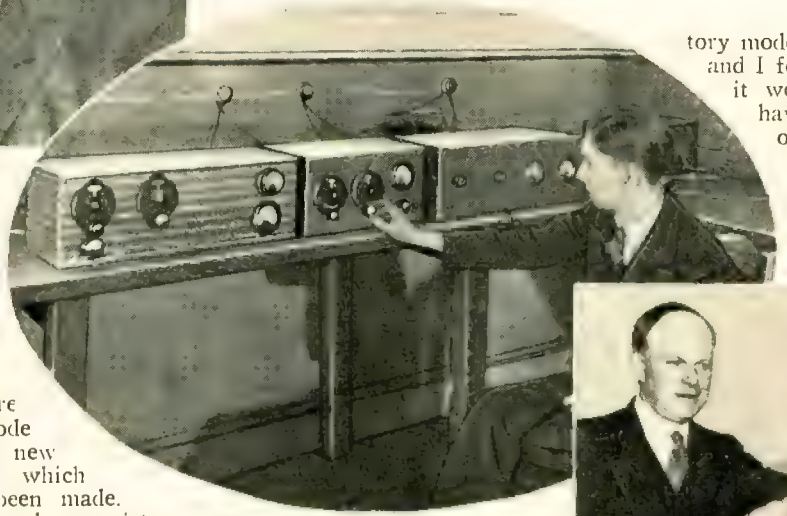
Unscrambling the Ether

By A. Dinsdale

The Latest Radio Wonder Is a Superselective Receiver, Called by Its British Inventor the Stenode Radiostat, which, While Giving Undistorted Reception, Will Even Produce Silent Places on Your Dial Between Stations

Dr. James Robinson, D.Sa., inventor of the Stenode Radiostat.



A laboratory model of the Stenode at the London Headquarters of the British Radiostat Corporation.

THOSE of our readers who are interested in radio matters have no doubt seen more or less vague references here and there to the Stenode Radiostat, a marvelous new British invention for which startling claims have been made. Those who regularly read our sister publication, RADIO NEWS, will have learned a little more about it in recent issues. At the time of writing there have just arrived in this country Dr. James Robinson, D.Sc., inventor of the new receiver, and Percy W. Harris, Chief Engineer of the British Radiostat Corporation, and well-known English radio editor and set designer. They have brought with them demonstration models of the Stenode which they immediately proceeded to demonstrate in Washington before members of the Federal Radio Commission, and engineers of the Navy and Army. From there they proceeded to the Chicago Radio Show.

The claims made for the Stenode Radiostat are that it gives a degree of selectivity never before dreamed of, and does so without cutting sidebands (to use a popular expression). The R.F. resonance curve of the receiver is only 100 cycles wide (See Fig. 3). This means that an unwanted station, broadcasting on a frequency close to that of the desired station, would cause but little interference. As a matter of fact, the receivers brought over here will eliminate entirely stations only 5 Kc. removed from the desired station. There is absolutely no interference at all, either from a heterodyne beat note (caused by the two interfering carriers) or from cross-talk.

The significance of these claims is that there is no longer any necessity for spacing broadcasting stations 10 kilocycles apart. They can be crowded much closer together and, provided everybody uses Stenode Radiostat receivers, clear undistorted reception can be had from all stations without any interference. This means that we can build a lot more broadcasting stations, and do so without causing the Federal Radio Commission any sleepless nights. It also offers a solution to the difficulties of television experimenters who, as all the world knows, are being kept off the air because there is no room for the very wide frequency bands which they must broadcast. The amateur, whose narrow wavebands are so congested that he is being asked not to use phone, can equip himself with a Stenode and use phone to his heart's content. And finally the principles of the new invention can be adapted very advantageously to all other branches of electrical communication.

And what of the value of these claims? Well, through the courtesy of Dr. Robinson, I had an opportunity some months ago of handling a laboratory model of the receiver in London, and I found that all claims made for it were fully justified. Also, I have just had an opportunity of testing out one of the receivers right here in New York, and I can only say that I am amazed at the super-selectivity of the instrument. And the quality of reproduction is considerably better than that of many modern commercial sets of orthodox type.

Left to right: Dr. Robinson, Arthur H. Lynch, Editor of RADIO NEWS, and Percy W. Harris, Chief Engineer of the British Radiostat Corp., photographed in Washington with one of the Stenodes which have been brought to America.

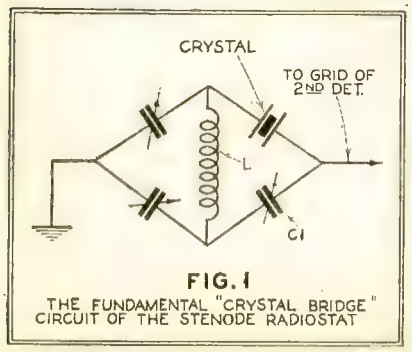


FIG. 1
THE FUNDAMENTAL "CRYSTAL BRIDGE" CIRCUIT OF THE STENODE RADIOSTAT

Unlike many inventors, Dr. Robinson has behind him the weight of a very solid scientific background. Before the outbreak of the World War in 1914, he was a lecturer in physics at various British universities. The early part of the war found him engaged in wireless work for the British Navy, whence he was transferred to the Royal Air Force. During that period of service he invented and per- (*Cont'd on page* 856)

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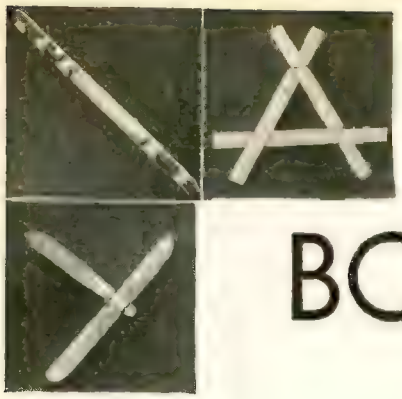
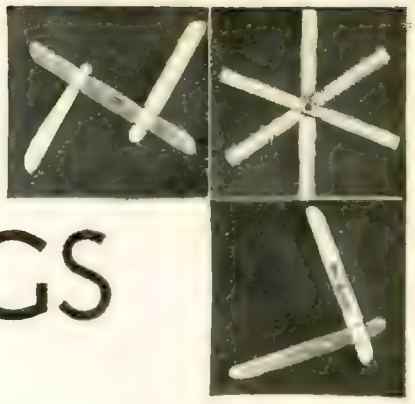


How to Make and Throw BOOMERANGS



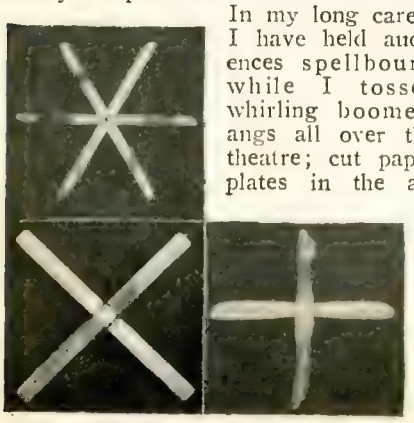
By William H. Van Shrum

of the Vaudeville Team of Van and Belle

WHAT does the word boomerang mean to you? Is it merely a dictionary term, quite useful in political oratory and conversation, or does it recall pictures of a half-naked, crouching savage, holding a long, narrow stick, tensely awaiting the instant when he will hurl his weapon and bring down a bird? Do you see in your mind's eye a horde of brightly painted, gruesomely decorated tribesmen releasing a hail of flying, curving missiles almost impossible to dodge? Can you imagine them dancing around their campfire at night to the accompaniment of weird cries and shrill shouts exulting over the victims of their deadly boomerangs? Do you know that that weapon was merely a piece of curved wood which would travel in a circular path through the air and return to the thrower?

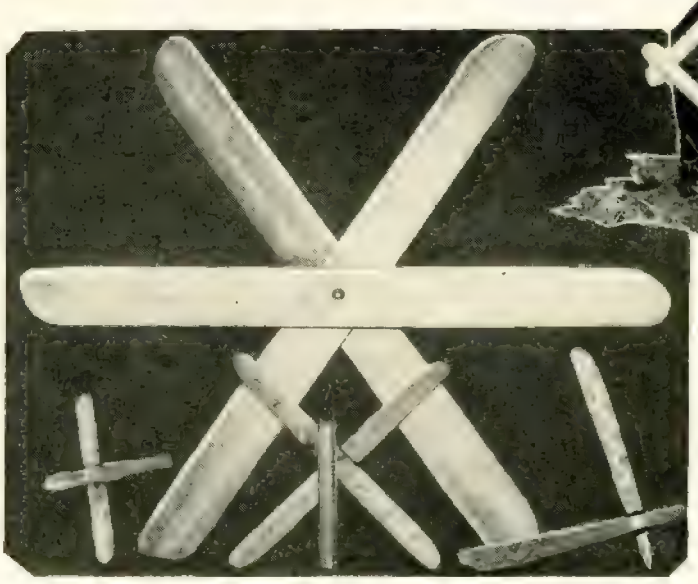
Originally boomerangs were the products of primitive man, notably the Australian aborigine. He used them both as a weapon of attack in open warfare and as a projectile to bring down small game and occasionally animals as large as deer. The deadly accuracy with which the natives hurled these weapons enabled them to protect their own lives and wrest a living from the forests. The effectiveness of the boomerang can be attributed to the fact that it travels in a curve and is difficult to avoid even when noticed beforehand by the animal which it is intended to strike. The size and weight of the boomerangs which these warriors were accustomed to use is astonishing. A six-foot oak boomerang was not at all uncommon. These unusual weapons, however, are unwieldy and hard to control.

Today I use adaptations of these deadly weapons to entertain audiences. In my long career I have held audiences spellbound while I tossed whirling boomerangs all over the theatre; cut paper plates in the air with them; struck down Indian clubs placed in a line, one after another; and filled the air with whirling wings, which I caught in rapid succession. With an understanding of the principles governing the flight of boomerangs, I am able to make them cut capers of which their native originators never dreamt.



Boomerangs, if properly handled, duplicate all the tricks performed by the stunt aviator. They will fly in wide or narrow circles, high in the air, or close to the ground, side-slip, fall away, loop-the-loop, follow a predetermined course and return to the spot from which they were thrown. Extraordinary as it may seem, you can make these spinning wings of inexpensive material, and a sharp jack knife is the only necessary tool.

Mr. Van Shrum about to release the boomerang. Note his position: He is facing the wind, and stands with his left foot forward; the boomerang is held in the right hand.



This collection includes the smallest and the largest of Mr. Van Shrum's boomerangs. The twelve-inch ruler in the center will serve as an indicator of their sizes.

The amazing flight of a boomerang which I saw when I was a small boy, about thirty years ago, so interested me that from that time on I have studied the art of making and throwing them. In fact, I can say that most of my life has been spent in studying the theoretical and practical aspects of the construction and flight of these spinning wings. After experiences lasting over a quarter of a century, I found that almost any kind of wood could be used. The heavier the wood, the further the boomerang will travel before it returns. Of course, greater strength and skill are required to throw a heavy boomerang than one constructed of light weight wood such as we will use.

After numerous trials with pine, oak, willow, bass and other woods, I came to the conclusion that balsa wood, procurable in various weights and grains, is best adapted to practically every type of boomerang. You can cut balsa very easily, and, unlike other woods, no finishing (such as sandpapering or planing) is necessary. Boomerangs made of balsa can be fashioned by the novice and do not require skill in handling. They are perfectly safe and with them the ordinary individual will find that he will soon be able to do the same tricks that the vaudeville artist includes in his act.

You can make the simplest boomerang from two long slabs of narrow wood, fastened in the form of a cross, by a rubber band at their midpoint. The long sides of these pieces are shaped so

(*Continued on page* 861)

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Birchanism, a new religion. Its adherents do not sacrifice to their gods, but tie presents for them to the trees.

The Back Modern

Priests Still Sacrifice Horses to Spirits; Animals ing Quarterly from One Village to Another Is the

By Count A. N. Mirzaoff

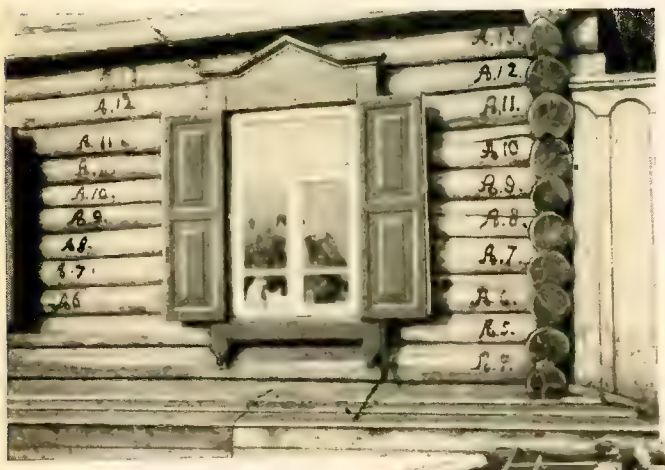
A LAND where man has been esteemed according to the number of livestock he can steal and hold, and one where each group has four villages, and moves from one to the next seasonally, making the complete round each year, were among those visited by the Lubinsky Expedition, which has just returned from North Central Asia and Siberia. The expedition turned east from the Volga, and followed the historic trail of the great migrations. It studied the conditions of life among the peoples of the vast steppes now included within the borders of the Kazak Republic and the Siberian area, and of the chill slopes of the Altai Mountains, where the tribal stronghold of the Oyrots forms a self-governing territory. Of all the peoples visited, the Kazaks are, perhaps, the most interesting. Turned back, at some time in the past, by the superior armament of Europe, they have remained at the stage in which the ancient Scythians were observed by the early Greeks. Only within the past few years have they begun to accept responsibility, learn industry and adapt themselves to settled social ways. The chief factor in changing their mode of life has been the recently completed "Turksib" railroads.

Women priests among the Shamanists must wear masks during holy services, so as not to divert the men's attention.

By occupation the Kazaks are herdsmen; their livestock including horses, cattle, camels, sheep and goats. It is horses, however, that they love best to raise and to acquire. The horse is not only transportation to them, but a source of milk and meat. And when one says "milk," one must take in a function not included in our own conception of milk—for the Kazaks make of mares' milk a fermented drink of considerable alcoholic content—milk with a punch, which they keep on tap at all times. This drink, called "kismiss," is the common intoxicating beverage of all horse nomads. In a fermented, but non-intoxicating state it appears in the Western World as a famous builder of health, fertility, and longevity.

In connection with the horse, one must modify the meaning of the term "just," as applied to the Kazaks. At least until lately it was their established practice, each fall, to engage in organized cattle and horse thieving raids, thus to increase their stock of both. (This custom still maintains with some groups.) To this type of raid they have given the name *baranta*—literally, to "make" or "lift" cattle; and with respect to this invasion of "property rights" (in our use of the term) the Kazaks up to now have been absolutely without moral or social qualms. Rather the opposite: He has been most honored who has been most successful at seizing and holding livestock which he has not bred or raised. This is part of the occupational ethics of every nomad herding tribe, and settled folk who adopt roving ways easily take to it, as one sees by the most casual survey of the business of cattle rustling in our own Western states.

Here is the interior of an Oyrot hut. The sick man stretched out on the ground is being treated in primitive fashion.



To the left—A typical Oyrot house. The beams are provided with numbers and figures, so that they can be put together in the same order, after one of their journeys.

These are not mere logs. . . they are the beams of the house pictured above, dissembled and ready for transportation.

During the summer season the Kazaks live in transportable tent-like shelters closely resembling the

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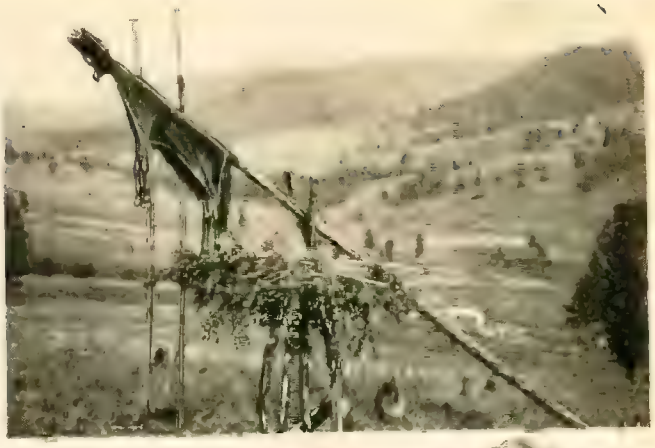
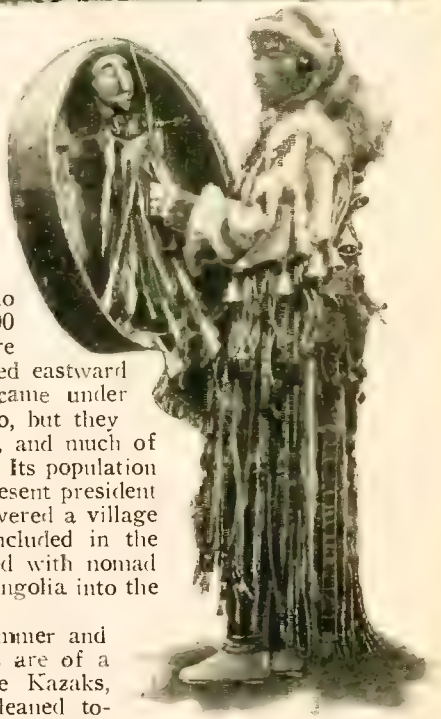
woods of Russia

and Human Beings Share Huts; and Mov- Style in North Central Asia and Siberia

and Murray Godwin



A favorite religious prescription among the Shamanists is sacrificing horses in an insanely brutal fashion. A totem pole, laden with the skin of a freshly killed horse.



The face of a god on a drum.

Mongolian yurts. They are circular in form, with walls of latticework and tops of springy wooden strips, over all of which are stretched sections of felt made from wool and camels' hair. A hole at the summit permits smoke to escape and light to enter. The felt covering is necessary because of the chill of the night air even in the warmer seasons on the steppes.

For winter homes the Kazaks have permanent structures, rudely built of logs or slabs and clay or stone. Within these huts not only the human beings, but the less hardy animals of the herds spend the colder seasons of the year.

"Only the doctor whom Lenin sends can help you," — the modern spirit. A sick man being treated by a Russian doctor.

Long coats stuffed with wool, trousers similarly made, high leather boots with heavy lining, and fur caps which expose only the face, compose the winter dress of the Kazaks. Their summer dress is not much lighter. Milk and meat are their regular diet, together with a few simple additions like cakes made of flour and mutton fat. They are Mohammedans in religion, and until recently their women were treated as markedly inferior to the men of the tribe.

Under the former government the Kazaks were divided into tribal groups and assigned to certain grazing regions, the object being to keep them from coming together for possibly hostile resistance to the state. As citizens of an autonomous republic, they now have their own general assembly at the capital city, Alma Ata, near the southeastern border.

Touching the border of the Kazak Republic on the east is the Oyrot autonomous territory, in the foothills of the Altai range, which extends southwest into the land of the Mongols.

Like the Kazaks the Oyrots are horse nomads, but they are making increased efforts to cultivate the soil. They have wandered, in the past, many thousands of miles. Coming into Russia through the Caucasus about 1300 A.D., they roamed as far as Finland, where some of them remained. The rest returned eastward to their present home. Partially they came under Russian domination 200 years ago, but they have never been really conquered, and much of their region is unknown country. Its population is subject to sudden shifts. The present president of the area on one occasion discovered a village of 2,000 which had not been included in the government census. It had moved with nomad disregard for boundaries from Mongolia into the Oyrot territory.

The Oyrots live in yurts in summer and log houses in winter. The yurts are of a different type than those of the Kazaks, however: straight saplings are leaned together, tepee (*Continued on page* 863)

Canals are a rarity in these primitive regions. The natives employ a water carriage to bring their supply of water into the city from bordering rivers.

A Kirgheez milking his horse. A fermented drink of considerable alcoholic content is made from mares' milk.

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Mechanical Ears

The Weird Contrivances Here Are Designed to Give Anti-Aircraft Defence Units All the Information They Require Concerning Approaching Aircraft

By Chester McDonald

IF you have ever observed a wild animal in his native haunt, you will undoubtedly have noticed that the slightest suspicion of a sound indicative of danger will cause the animal to suspend all other activities, raise his head and turn it in the general direction from which the sound came, and cock his ears. Nature provided him with long ears for just that purpose. He will then stand motionless until further sounds arrive either to reassure him or warn him of danger. Certain species of animals go one better. While they are feeding they will post a lookout in an advantageous position, usually on an eminence, and it is his duty to keep a sharp eye and a cocked ear for the first hint of danger, and give due warning to the rest of the herd.

Records show that the highest type of animal, man, behaved in an exactly similar manner during the earlier phases of his development. Even today, certain isolated tribes of so-called "savages" protect themselves by such methods.

But the range of man's unaided senses is strictly limited. Vision is limited by the condition of the atmosphere and the curvature of the earth. Hearing is limited by the intensity of the original sound, the density and movement of the medium, usually air, through which it has to travel and the number of reflecting, refracting or absorbing objects which may lie in the path of the sound waves. Most solids conduct sound waves better than gases; hence the practice of certain aborigines of placing an ear to the ground to catch the sound of an otherwise inaudible approaching enemy.

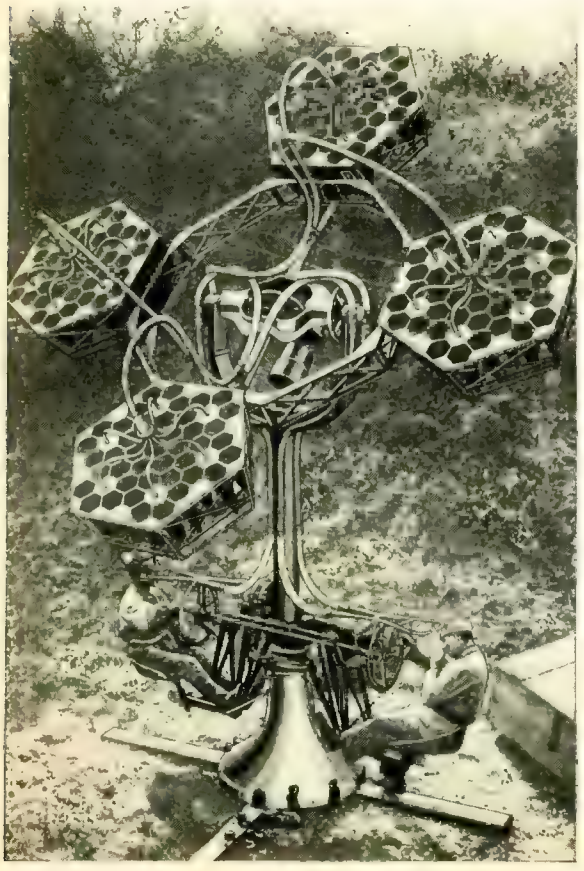
In these days of highly developed electrical communication, particularly the telephone and telegraph, we are apt to overlook the fact that these aids to long distance communication entail the installation of terminal equipment at the two communicating stations, and also of some special connecting link between them. Faced with the necessity of receiving intelligence from a distance greater than the range of our unaided senses, and under circumstances where it is either impossible to install equipment at one terminal and provide a connecting link, or where one party to the intercommunication does not desire to co-operate, the realization is immediately forced upon us that we are backward in the development of independent aids to our senses, independent, that is, so far as the other party is concerned.

A French officer supervising the observations being made with the aircraft detector unit shown at the bottom of this page.

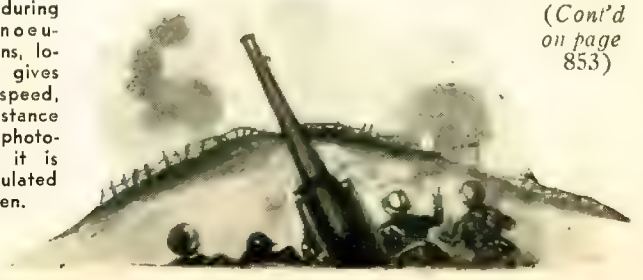
Our only independent means of extending our vision is by means of a telescope or microscope. In the realm of sound, Nature did not provide us with long ears like those of the animal, or if she ever did, they have become attenuated during the process of evolution. In our efforts to catch faint sounds we instinctively imitate animals to the best of our ability by cupping a hand behind an ear. The mariner goes one step further and communicates over distances of several hundred yards by using a megaphone to concentrate and direct the sound waves issuing from his mouth and, at the receiving end, he amplifies incoming sounds by placing the mouthpiece of the megaphone to his ear and pointing the open end towards the source of the sound.

It was not until the World War that the acute necessity arose for us to reinforce these primitive methods still further, and under the stress of war a

(Cont'd on page 853)



This device, which was used by the French army during autumn manoeuvres near Lyons, locates planes, gives their flying speed, height, and distance away. As this photograph shows, it is easily manipulated by two men.



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Spectacular Electrical Experiments

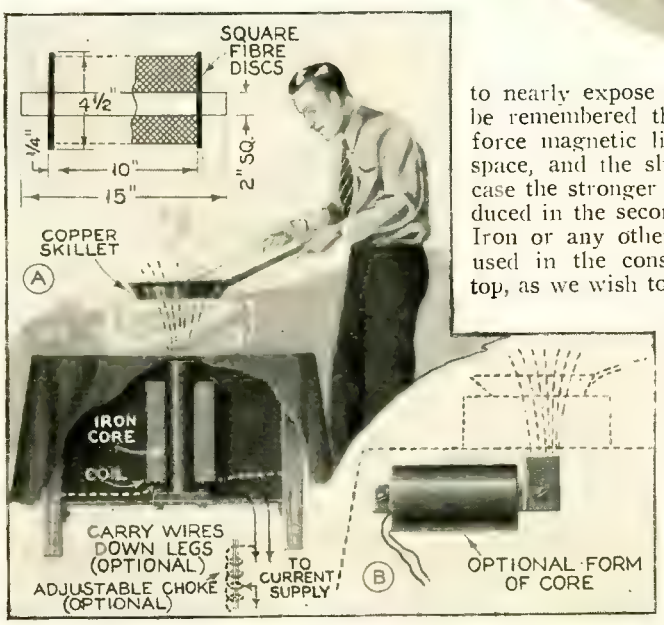
Two iron bars, a glass battery jar, and a suitable current supply are the requisites for performing this unusual demonstration.

By John P. Morris

MANY of the spectacular and mystifying effects which the magician produces on the stage can be duplicated by you in your own home. Very little equipment is necessary, contrary to general belief; and whatever material must be purchased can be bought reasonably. Usually the odds and ends found about the average experimenter's workshop will serve his purpose.

Some night, when you have a group of friends around, try frying eggs on ice. Or weld iron bars under water. Causing a ring to float around in the air, and lighting a lamp which has apparently no current source can be included in your repertoire. The only apparatus you may have to purchase for these four tricks is a second-hand transformer. It may be of the three-legged core type illustrated, in which case the primary coil can be wound on a form or spool, as indicated, and the secondary coil wound over the primary on the same spool, threading the sheet-iron laminations into either end of the spool until the core is entirely built up.

One trick you can try is frying eggs on ice. While this trick has never failed to excite the wonder of the audience, it is quite simple to build up the necessary apparatus: a powerful alternating current magnet is placed under the table, and the rapidly alternating magnetic lines of force emanating from the magnet, pass right through the ice and induce an alternating current of low voltage and high amperage in the copper skillet containing the eggs. The skillet obeys Joule's law, I^2R, heat is evolved and we have eggs fried without a stove.



The copper skillet becomes hot when current is passed through the magnet in the table. Try preparing your breakfast this way!

The coil to which the lamp is connected forms the secondary winding of a transformer. The primary coil is the magnet located in the table.

The pan forms a secondary circuit of an A.C. transformer, the magnet under the table playing the role of core and primary winding. A copper pan will give the best results, as it offers the lowest electrical resistance and will allow the greatest current to flow in the pan.

The table containing the magnet may be covered with velvet or cloth. Its top can be a sheet of thin bakelite, or else the end of the magnet may be brought up as high as possible by cutting out part of the wood so as to nearly expose the magnet. It must be remembered that it takes power to force magnetic lines of force through space, and the shorter the gap in any case the stronger will be the effect produced in the secondary stage or circuit. Iron or any other metal should not be used in the construction of the table top, as we wish to conserve all our lines of magnetic force and concentrate them upon the object which forms the secondary circuit.

Best results will be obtained if the magnet has an iron core (laminated or built up of sheets bolted or clamped together at the ends) 15″×2″×2″ in dimensions. The coil consists of eight layers, ten inches long of number ten B. & S. gauge D.C.C. magnet wire (with insulating fabric between the layers). Taps are connected to the sixth, seventh and eighth layers to provide adequate control of current consumption. The magnet connected to 110 volts, 60 cycle, A.C. circuit usually draws about 10 amperes. The core requires approximately 17 pounds of sheet iron and the coil about 20 pounds of magnet wire.

An interesting experiment demonstrates the reaction which occurs when an aluminum ring is held in the magnetic field of a powerful magnet. The ring may be made from a piece of wire joined together with a clamp, or the ends may be welded. Experimenting with various sizes will finally give you a ring which will yield the best results. As shown in our sketch, the wire is to be secured by three threads which are, to all practical purposes, invisible.

To light the mystic lamp, a secondary coil is constructed and placed in the hollow wood (*Continued on page* 847)

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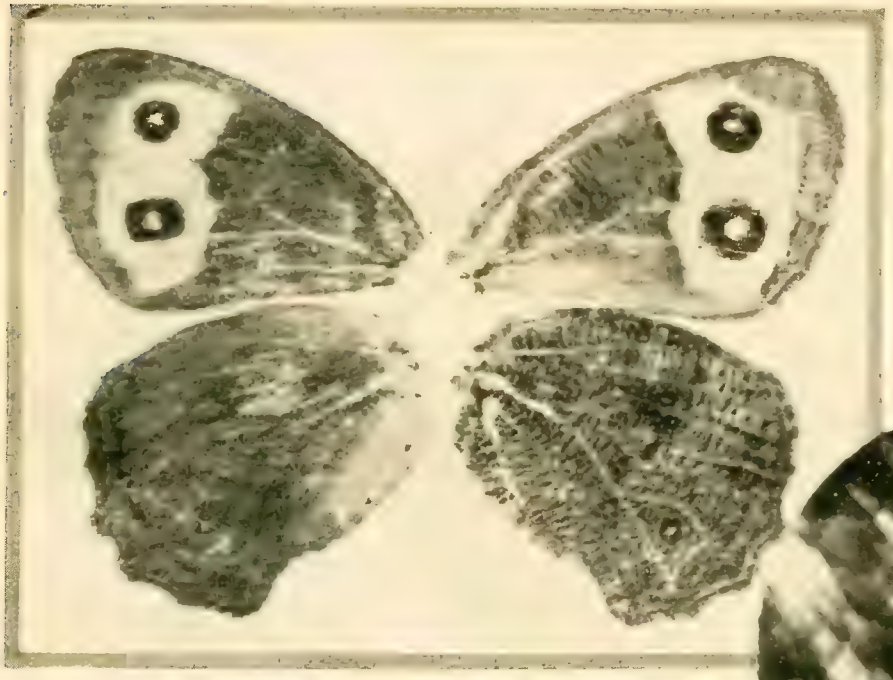


The delicate pattern of a pair of butterfly wings impressed on a sheet of wax paper. Note how all details are preserved.

How a butterfly wing appears through a microscope. A single scale, which contains the one-color pigment.

Butterfly Wings Are Not Varicolored

By Dr. E. Bade

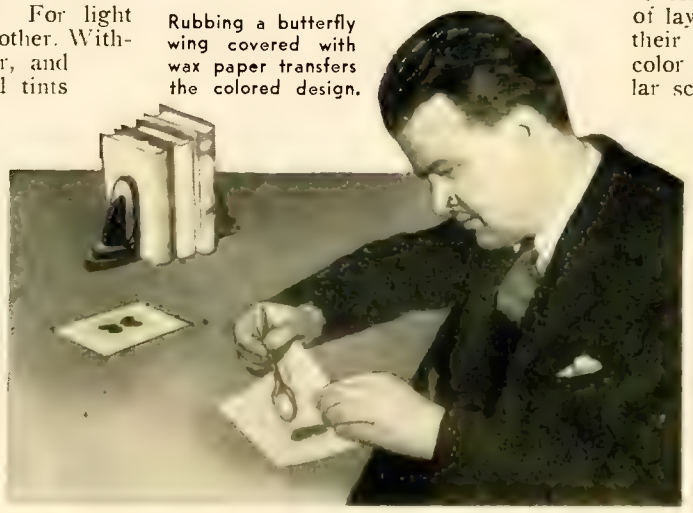
IN the depth of the ocean with its eternal light, only black and a few red creatures are found. And here red is equivalent to black, as it is invisible in the dark abyss. For light and color complement each other. Without light there is no color, and there are no gayly painted tints of nature. Even the small number of animals which live in caves below the surface of the earth where no ray of light penetrates are either dark or flesh-colored, since pigments can not be developed where there is no light. But where animals live in sunlight, gay colors are the rule.

Color is a normal product of the organism, a formation of the normal living body. Both color and markings are not the result of the haphazard working of nature, but depend upon a certain regularity.

By natural selection only those forms are retained which are not only adapted to but more or less protected by their surroundings in spite of vivid or glaring colors. Those forms which are not protected in color or markings which blend with their surroundings usually die. Another way of saying the same thing is that the animal must be adapted to its environment, if it is to live.

Nature has been generous, indeed, in distributing colors to insects. Nowhere do we find the variety of color, glittering and sparkling of fiery tints as here. Color in butterflies is given by a fine dust scattered symmetrically upon the upper and lower surface of the butterfly wing. This dust resolves itself, under the microscope, into scale-like particles, arranged upon the transparent wing like the shingles on a roof. They are held quite loosely in place by means of little handles which fit into tiny sockets. It is these scales which give all color to the butterfly; the wing itself is as clear and transparent as glass.

Rubbing a butterfly wing covered with wax paper transfers the colored design.



The scales are hollow and filled with air and the pigment found within is only a yellowish brown mass. Gay colors are produced by interference and the breaking up of the light which is reflected as color. Each scale consists of layers, and the number of layers and their thickness give us the various color values. In addition, each particular scale is definitely marked and provided with wavy lines, protuberances and ornamentation which are clearly visible under a good microscope. In this way, with the simplest of methods, nature brings forth her exquisite colors in fiery and subdued tones.

It is quite easy to make prints of butterfly wings, whereby the gayly colored and minute scales are transferred in all their beauty to a piece of paper. No apparatus is required and no particular skill demanded. All that is needed is a piece of thin wax paper. Cut the wax paper just a little larger than the spread butterfly. Fold the paper in half, break off the upper and lower wing on one side of the butterfly and place between the folded wax paper. Place carefully in position. Cover with a strong and firm piece of paper and then rub this paper strongly and firmly with the rounded bowl of a spoon. Of course the paper must be rubbed immediately over the wings. This rubbing drives the scales into the wax of the wax paper, (*Cont'd on page* 853)

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In the SPOTLIGHT of SCIENCE

Germany's Most Original Modern Settlement

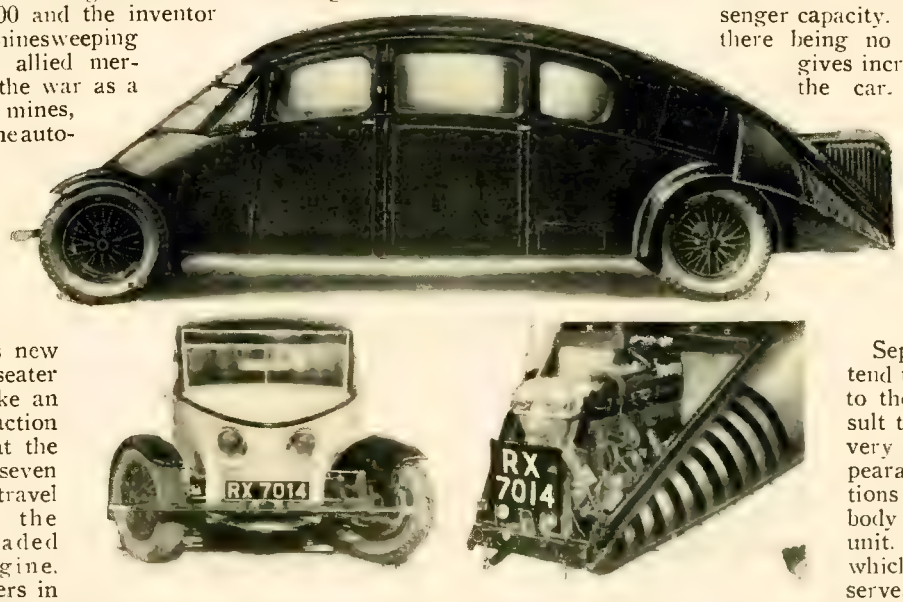
EVER since the termination of the war, Germany has been busy on reconstruction programmes, with special attention being given to the provision of modern housing facilities for her workmen. Many of these new settlements are vast in extent, daring in conception and models of comfort and convenience by comparison with the slums which formerly housed the working classes. The rents, designed for the workman's pocket, are amazingly low for the facilities offered. Pictured above is Germany's most modern settlement, called a Rundling, or round city, located in Leipzig-Loessnig. The constituent blocks of flats are built concentrically in order to provide a maximum of light and air. The builder is Stadtbaurat (city architect) M. Ritter, of Leipzig, whose originality is deserving of favorable comment.

The Burney Streamline Car

DESIGNED by Sir Dennistoun Burney, the brilliant designer of the British airship R-100 and the inventor of the Paravane minesweeping device used on all allied merchant ships during the war as a protection against mines, the Burney Streamline automobile is the most outstandingly original car that has appeared for years.

Utilizing his wide airship experience, the designer equipped his new car with a seven-seater body streamlined like an airship. By this action alone it is said that the complete car, with seven passengers, will travel faster than will the stripped and unloaded chassis. The engine, having eight cylinders in line, develops 22 H.P., and the car will cruise at 70 M.P.H. and attain a maximum speed of 80 M.P.H.

Contrary to usual practice, the engine is fitted in the rear of the car, as a result of which rational manoeuvre it is said that the interior of the car is noiseless and free from the heat and smells of the engine. All the occupants of the car hear is a faint swish of air as the car travels along. All the passengers are carried well between the axles, thus ensuring a maximum of comfort. Considerable weight reduction, resulting in decreased tire wear, has been effected. The new car weighs only 4256 pounds, as compared with 6272 pounds for an orthodox car of similar power and passenger capacity. The body is low hung, there being no running board. This gives increased head room inside the car. Body squeaks and rattles have been eliminated by building the chassis and steel body frame in one unit, instead of, as is customary, building the body as a separate unit and afterwards fitting it to the chassis.



The top photograph gives an excellent impression of the appearance of the new Burney Streamline car, which is low hung, and has its engine placed at the rear. Photo at left shows how the headlamps are imbedded in the body, and the 50 degree lock which gives the car a turning circle of 39 feet. A closeup of the engine is given at right.

Separately fitted bodies tend to "work" in opposition to the chassis, with the result that squeaks and rattles very soon make their appearance. No such conditions can arise where the body and chassis are a single unit. The steel frame upon which the body is built also serves to strengthen the chassis, with the result that the chassis frames can be made of lighter material. Each wheel is separately sprung, giving as nearly perfect a springing system as it is possible to make, and one which remains perfect either at low speed or high speed. The shifting of the weight to the rear axle greatly reduces the possibility of front tire bursts. Possible disadvantages include vulnerability of the engine to rear-end collision.

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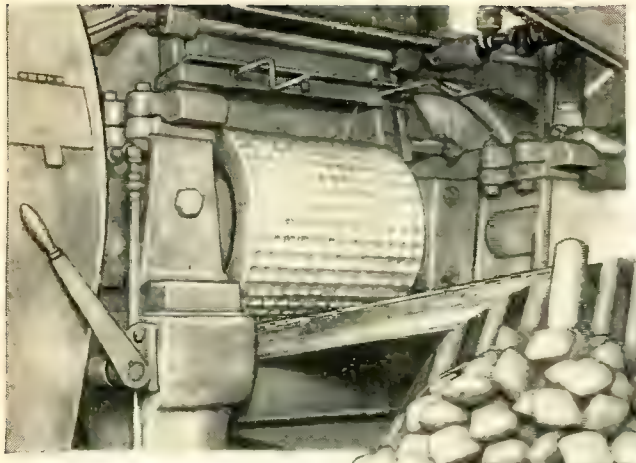
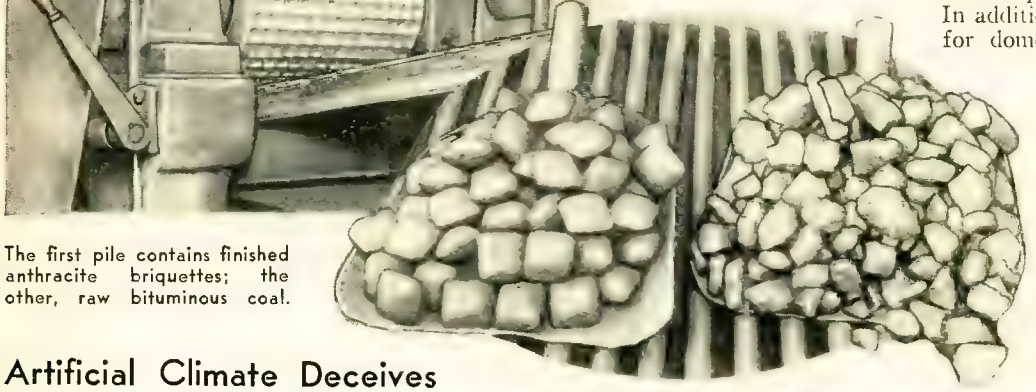
Smokeless Anthracite from Bituminous Coal



Briquetting press. The revolving drums mould the finished product after it has been mixed with asphalt.



The first pile contains finished anthracite briquettes; the other, raw bituminous coal.

A TECHNIQUE which duplicates in a few hours the process which requires millions of years in nature—the converting of bituminous coal into a high grade anthracite—has been perfected after eight years of intensive experimentation. It is the long-sought low-temperature carbonization process. In addition to producing smokeless fuel for domestic use at three dollars per ton less than mined anthracite, it yields large quantities of gas of a high heat value and two to three times the quantity of the by-product, tar, that would be realized from high temperature carbonization. The plant, which was opened recently at Chicago by Thomas Hitchcock, Jr., and C. E. Boyer, will help greatly toward the elimination of unnecessary smoke.

Artificial Climate Deceives Plants

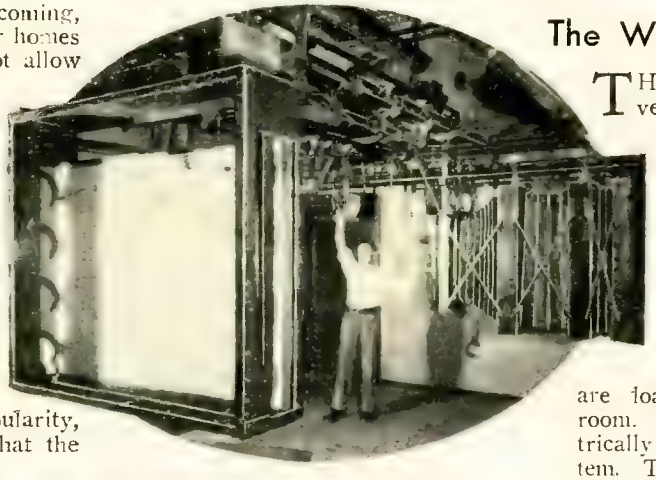
EXPERIMENTS conducted by the United States Department of Agriculture reveal that some plants which normally flower in the fall, such as the late cosmos, will blossom in early summer if given proper treatment. Through the efforts of research workers at the Boyce-Thompson Institute, plants have been grown in an artificial climate with fair success. Electric lamps are used to simulate the various seasons; the plants are fooled, and bloom.

Safety Chute Lessens Hospital Fire Hazard

THE Marlboro Hospital located in Marlboro, Mass., claims it has perfected a fire escape which provides a most expedient means of evacuating the hospital without discommoding the patients It consists of a steel tube which leads from a hospital room to the street. The incapacitated are brought to this room (there is a different tube for each floor) and placed on mattresses, which are pushed into the tubes. The glide through the tube furnishes a swift, sure, and comfortable means of exit.

Model Apartments for Birds

THOUGH cold winter is coming, the songsters who make their homes about Lawrence, Kansas, do not allow the housing situation to worry them. Hundreds of bird houses furnished to suit the tastes of the most discriminating birds have been erected and distributed by their builder, F. L. Hunt, about the grounds which encircle his home. Though a piano tuner by profession, his pastime and hobby is playing architect and landlord to his feathered friends. They seem to appreciate Mr. Hunt's consideration and, despite their popularity, there seems to be no danger that the rent will be raised!



The World's Largest Camera

THE United States Geological Survey at Washington, D. C., is in possession of the biggest camera ever made. This Gargantuan picture-taking machine weighs three and one-half tons, inclusive of associated equipment. With it, photographs covering an area of nine square feet can be taken. Not all of the gigantic machine appears in this illustration. The plates are loaded and inserted in another room. The apparatus is operated electrically through a remote controlled system. The camera is in constant service and the results achieved have proved highly satisfactory.

J. G. Berry, of the United States Geological Survey at Washington, D.C., is shown with the world's largest camera.

The enthusiastic bird lover surrounded by some of the modern bungalows he has constructed to shelter his winged dependents.

Television for Horse Race Fans

IF the plans of Parisian television experts materialize, race track enthusiasts will be able to sip their drinks in their favorite boulevard cafés and see the horses, on which they have bet, tear down the home stretch to victory. All the thrills experienced by those attending the races will be theirs, for television screens are planned for the larger bars and cafés throughout Paris.

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New Wind Tunnel for University of Detroit

THE effect of a gale roaring along at a hundred miles per hour can be reproduced in the new convertible open or closed wind tunnel just built for the Aerodynamical laboratory for the University of Detroit. Apparatus of this sort effects a great saving in the cost of experimental work. It is not necessary to build a full size machine to test out a new theory or discover whether an improvement is practical. Airplane models whose wing span does not exceed a six feet length can be tested for air properties, as can miniature automobiles and other machines. The University of Detroit is one of the pioneer colleges to establish a regular course of study in aeronautical engineering.

Professor Altman testing the apparatus which produces a roaring hundred-mile-an-hour gale.

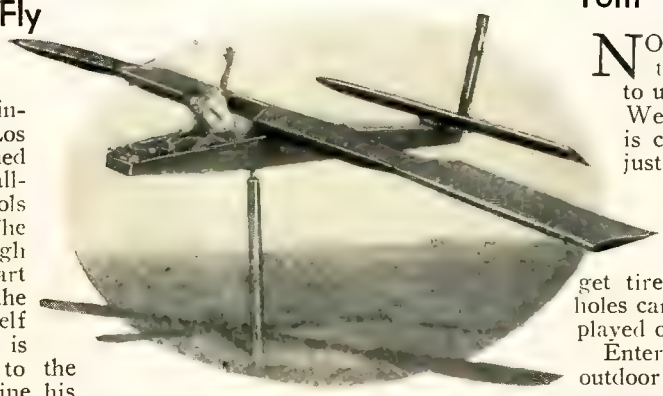
Close-up of the new wind tunnel. Note its size in comparison with that of the two men in the foreground.

Sea Shell Glass Transmits Health Rays

A SPECIES of large sea shells found in abundance about the Philippine Islands have been discovered to be good transmitters of ultra-violet and infra-red rays. The large, thick shells, when set in leaded panels and properly laminated, afford sections about four inches square. They are being processed for use in bathrooms, sun porches and invalid rooms. The photograph shows the shells used for covering a baby's cot.—*Lee McCrae.*

This Glider Wouldn't Fly

THE prospective pilot can learn to fly safely if he uses the new style ground glider invented by Paul Chamberlain, of Los Angeles, California. It is fastened atop a ten foot post with a ball-bearing top and has all the controls of the regulation sail plane. The beginner gets in and goes through all the operations necessary to start his glider; he remains on top of the pole. After familiarizing himself with the controls, the student is blindfolded, and his reactions to the wind on this test glider determine his advancement in glider flying. When he has progressed sufficiently, the young man is permitted to go up in another glider and really soar.



You can do anything but fly in this glider. It's for beginners, and remains attached to the pole.

An Electric Parent

FATHER and mother can sleep in peace, certain that baby is not crying or has not fallen out of its crib, even though they're sleeping in another room. For E. S. Darlington of the General Electric Company has rigged up a mechanical device to eliminate the sleep-walking scene so common when baby starts to cry. A telephone transmitter, used as a microphone, is connected by wire from baby's crib to an amplifier and loud speaker located close to father's ear. Baby's first cry will awaken him.

Smoke Elimina-or

ACCORDING to H. O. Caldwell, Editor of *Electronics*, the smoke nuisance in New York City could be controlled and promptly ended by municipal authorities, if they would enlist the aid of electronic devices already developed and in use. He refers particularly to the electric eye, which is a photo electric cell to be placed near the bottom of a smoke stack. When smoke rises in the stack, eclipsing the cell, relay-actuated blowers deliver an excess of oxygen to the furnace. This oxygen burns up all smoke.

Tom Thumb Golf Successor

NOW that Tom Thumb golf is on the wane, they found a new way to use miniature golf courses in the Western cities. Pool golf, as it is called, is all the rage now. It's just another variation of the ancient Scottish pastime. The game is played the same as table pool, only a golf club is used instead of the cue. When the players get tired of their miniature golf, the holes can be closed up, and golf billiards played on the same green.

Enterprising owners of indoor and outdoor courses who realize that their success depends upon keeping one jump ahead of the public, are altering their links so that the followers of the latest fad will be able to play pool golf.

The unsightly, weed-covered, empty lots that were transformed into attractive miniature golf links, are now being used for a new game. Here is Miss Betty Leight of Los Angeles playing pool golf.

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Meet the Family Blimp

At left is a photograph of the new family blimp climbing rapidly into the air. Below—A close-up of the control car, with Capt. Anton Heinen, the designer, waving his cap.

FIRST the enclosed cabin family airplane; now the small family blimp. This latest creation, the work of Capt. Anton Heinen, former executive of the Zeppelin Aircraft Company, Germany, takes the form of a 104-foot non-rigid dirigible powered by a 100 H.P. Brownbeck Tiger six-cylinder engine. Hydrogen is used for inflating the gas bag. The two vertical fins at the stern are the rudders, and the two horizontals the stabilizers and elevators. The gondola, of mahogany construction, seats four, including the pilot. Weighing about 1,800 pounds, the new air yacht can carry a pay load of 850 pounds, giving it a total lifting capacity of about 2,700 pounds. It is to be manufactured on a commercial scale in a plant built in Atlantic City, N. J., and will sell for less than $10,000, it is announced. The craft can be moored by one man and during a recent test was anchored in 46 seconds. According to Capt. Heinen the airship can be landed within the space of an acre, or less. Several test flights have been made which have proved that the new blimp has very easy maneuverability. On starting up the engine for a flight recently, however, an explosion occurred which slightly injured three of the crew and damaged the gondola. This explosion was said to have been due to over priming of the engine, made necessary by cold weather.

A Modern Rainmaker

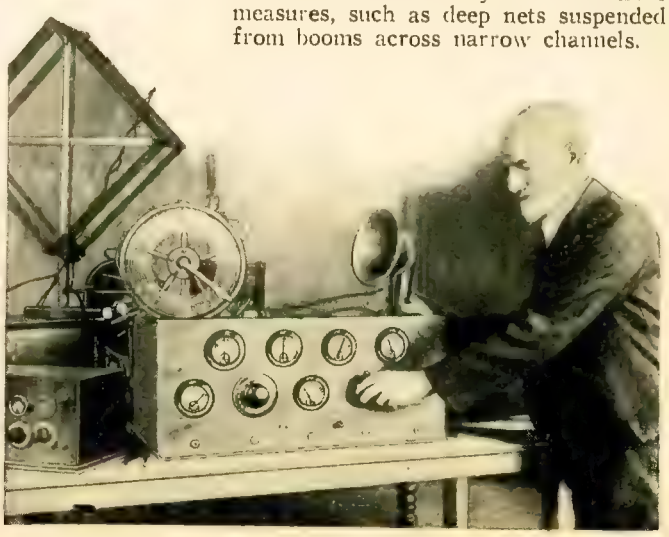
SINCE it is the lot of the human race never to be satisfied, grumblers about the weather are to be found the world over. It's either too hot or it's too cold; it's too wet or it's too dry. And the man who is most concerned about the weather is perhaps the farmer; he has good reason to be. And did you ever meet one who was entirely satisfied? And so we have always had with us the medicine man, witch doctor, rainmaker—call him what you will, who, right down through the ages, has claimed, and in some cases really attempted, to be able to control our fickle weather. Up to the present, however, most of these efforts remind us of the story of King Canute ordering back the sea at Hastings. Our most modern rainmaker is Dr. G. A. I. M. Sykes, of New York City, who directs an organization which he calls the Weather Control Bureau. For the period of the Belmont Park Races this fall he guaranteed the Westchester Racing Association that no rain would fall during the meeting. For the first few days no rain fell and he collected $7,500 in fees, but on Futurity Day, the most important day of the meeting, rain did fall, and under the agreement Dr. Sykes forfeited $2,000. Nothing daunted, however, Dr. Sykes made arrangements to produce a rainstorm between 2.30 and 4.30 p.m. on a given day, just to show he *could* control the weather. The appointed day came and went, but no rain fell, in spite of the efforts of the rainmaker. Dr. Sykes' array of antiquated-looking radio equipment, does not impress us as providing an effective means of controlling the weather.

Above—The mysterious structures erected by Dr. Sykes at Belmont Park for the control of the weather during the race meeting.

Right—Dr. Sykes with his imposing array of radio equipment.

U. S. Submarine's Record Dive

THE new U. S. submarine, V-5, in her first official deep sea diving test off Boone Island, Me., established a record for the navy of 332 feet. The previous record was 300 feet. The V-5 was down for forty-five minutes, during which time tests were made of her pumps and machinery, which functioned perfectly. On board the submarine were Rear Admiral Phelps and seven officers of the industrial research department of the Portsmouth Navy Yard. Lieut. Commander John H. Brown was in command, with six officers and eighty men. The mine-sweeper Falcon accompanied the submarine and stood by during the dive. Ability to submerge to great depths enables a submarine to evade enemy anti-submarine measures, such as deep nets suspended from booms across narrow channels.



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Where Tires Grow on Bushes

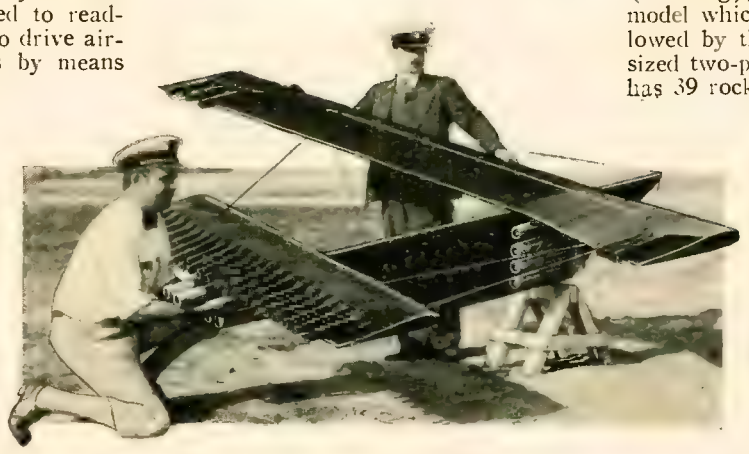
FOR twenty years or more, attempts have been made to produce rubber in the United States, thereby making this country independent of foreign interests which control the output of the world's rubber. The construction of a $150,000 plant near Salinas, California, 100 miles south of San Francisco, is the culmination of these attempts. Millions of guayule plants, imported from Mexico, and capable of yielding 1,000 pounds of rubber every four years, are now being grown successfully on a 25,000 acre tract at Salinas. With the successful solution of the problem of guayule plant culture, another giant industry is forecast for California. The final discovery of the treatment of the growing plant to cause the secretion of rubber was made by Dr. William B. McCallum, botanist of the American Rubber Producers, Inc., a subsidiary of the Intercontinental Rubber Company, and pioneer in the new California industry. Numerous experiments in various parts of the country had to be made to find the type of lands suitable for the growth of guayule plants. It has been found that the nurture of the shrub is all-important in causing the storing of rubber in the stalks. In order to extract this rubber, the entire shrub is crushed by machinery. The progress of this new industry will be watched with great interest.

Right—Part of the 25,000 acre tract near Salinas, Cal., where the guayule plants are grown from which rubber is made. Below—A slab of crude rubber extracted from California guayule.

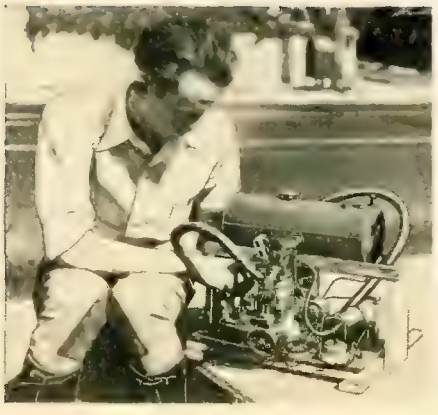
Right—This is the Guayule, a Mexican shrub with high rubber content. The entire plant is crushed and the rubber extracted by machinery.

Another Rocket Plane—American This Time

DURING the past few years we have grown accustomed to reading about various attempts to drive airplanes and surface vehicles by means of rockets. In almost every case, tales of these experiments have emanated from Germany. The factor which has lured inventors to this field is the possibility, by means of rockets, of obtaining enormous speeds, far in excess of anything now possible by means of internal combustion power units. Evidence that serious interest in the possibilities of rocket airplanes has spread to the United States is provided by this photograph, which shows Maurice Poirier, of Burbank, Cal. (standing), who invented and designed this queer looking contraption, which he plans to test in the near future. Franklin L. Wallace (kneeling), a pioneer pilot, built the model which, if successful, will be followed by the construction of two full-sized two-passenger planes. The model has 39 rockets, 22 of which are stabilizers. Poirier claims the model will fly at a speed between 350 and 600 M.P.H., and land itself. On the rocket planes the inventor plans to install gasoline motors for take-off and landing purposes. In contradistinction to continental practice, all the rockets will be lighted at once. It will be worthwhile following the career of this plane.



Tiny Gas Motor Used in Canoe



GASOLINE motors of very low horsepower are notoriously difficult to make and operate, but H. T. M. Rice, of Los Angeles, Cal., pictured here, went to work nevertheless and built himself a tiny motor which he has installed in a 13-foot canoe. The motor is so small it uses only one-sixteenth of a gallon of gasoline per hour, and with three passengers aboard, the canoe can make 6½ miles per hour. The cylinder has a capacity of 3¾ cubic inches, giving the motor a power of 2/1500 H.P. It has a pressure oil feed and two oil pumps, a drilled crankshaft, a 16 jet float valve barrel throttle carbureter, and a dry battery ignition system.

Alaskan Volcano Packed in Ice

THE idea of a volcano being packed in ice sounds so anomalous as to be almost incredible, yet two such volcanoes exist, according to the Rev. B. R. Hubbard, a Jesuit priest who has just returned from an exploration trip to Alaska. These volcanoes, both active, are Aniakchak and Veniaminoff, hitherto known only as locations on the map of the Alaskan peninsula, and not known to be active. Father Hubbard, in company with four Santa Clara University football men, chosen to stand hardship, packed more than 100 pounds each across Alaska and scaled the rim of Aniakchak first. The party then scaled Veniaminoff, inside the active crater of which they found a huge glacier, out of the centre of which rose a recently erupted cone.

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The Zaeharingen, Germany's Radio Target Ship

JUST as the practicability of substituting a robot for the pilot in an airplane was demonstrated a few months ago, we now have a radio controlled steamship.

The German Navy has recently equipped its S.S. *Zacharingen* with an automatic radio controller. No longer is it necessary to anchor a ship, or tow it behind some speedy greyhound for Fritz to indulge in target practice. Now, though no human being is on board, the boat he aims at is always under complete control. So efficient is the radio pilot that the boat can safely do twelve knots per hour, and can be stopped within a distance of eight hundred and fifty feet.

Radioing Any Planet Thought Possible

ACCORDING to Clyde Fitch, radio engineer, recent researches in infra-red radiation and short radio waves have indicated that communication with the various planets is theoretically possible. Ordinary radio waves can not be employed for this purpose, as the ionized air (the Kenelly-Heaviside layer), in the upper atmosphere, turns them back to the earth. "Radio waves only a few inches long," he said, "can now be generated, and these easily penetrate the Kenelly-Heaviside layer. The infra-red rays could also penetrate the atmosphere of the earth and other planets without scattering. The receiving apparatus for infra-red rays consists principally of a sensitive cell, so sensitive, in fact, that a match struck on the moon could be recorded on the earth."

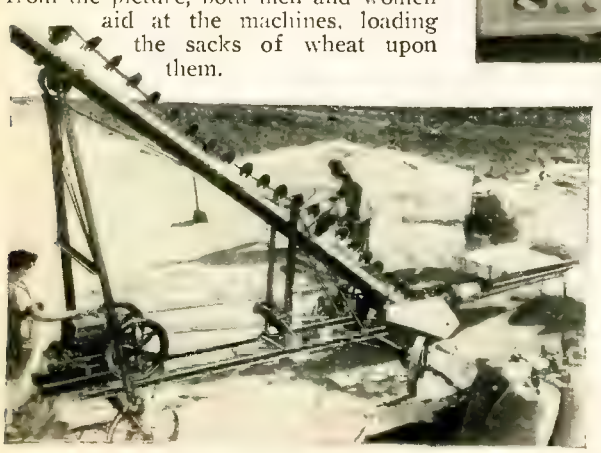
Speedy Life-Saving Motor Buoy

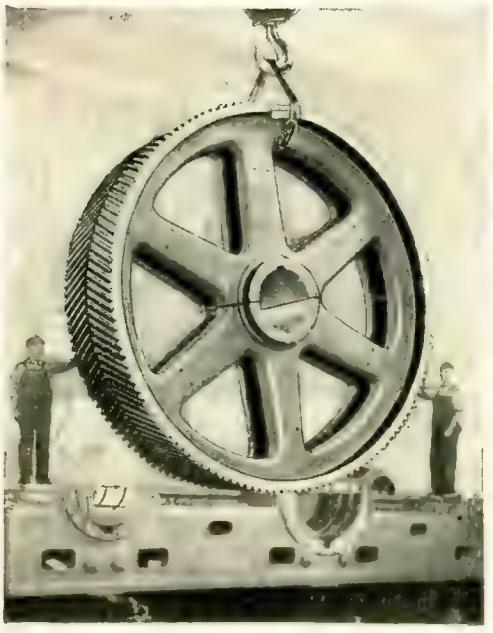
LOOKS like a cross between the sawed-off bow of a motor boat and a freak water sled, with two runners in lieu of a keel. It's the electric motor buoy invented and built by J. E. Haschke of Long Beach, California, for life-saving purposes. A propeller between the runners is driven by a small automobile starter motor, switched on and off by means of a button. The buoy only weighs seventy-five pounds and is supposed to be capable of towing the man, who hangs to a handle bar across the stern, through a raging sea at the speed of five hundred yards a minute. The life-saver clings to the handle by one arm; the other arm is free so that at all times he may use it to grasp and hold on to the drowning person. The device should prove popular at beaches.

J. E. Haschke's motor buoy in a life-saving experiment at Long Beach, California.

The Wheat Market—Another Russian Upheaval

THE world wheat market is being upset by The Union of the Soviet Republics. Producers there are underselling the United States and the other wheat countries by ten cents. When you consider that in three days the sale of wheat in the Chicago market amounted to 7,765,000 bushels you can understand that our Russian friends mean business. The cheapness of their products can be attributed partly to large scale production and partly to the fact that Russia is constantly importing the latest machinery. As you can see from the picture, both men and women aid at the machines, loading the sacks of wheat upon them.





Eighty-Ton Giant Gear

DESPITE their size, the teeth of this giant eighty-ton gear have a tolerance of only one one-thousandth of an inch for inaccuracy. The gear was recently installed at the United States Aluminum Company, Pittsburgh, Pennsylvania, and is the product of the Falk Corporation's Milwaukee plant.

It is surprising how accurate it is possible for a workman, living in the year 1930, to be. There are Johansson gauges which check four separate surfaces of an automobile counter shaft gear simultaneously. The dials indicate instantly the degree of error. There is one concern that holds its meter gauges to an accuracy of plus or minus four-millionths of an inch. A story descriptive of such precision instruments appeared in the July, 1930, issue of SCIENCE AND INVENTION.

A Foolproof Plane

HEINRICH FOCKO of Bremen, Germany, has just perfected what he contends is the world's safest airplane, claiming that it is foolproof against stalling and capsizing during landings. The stabilizer and tail of this revolutionary craft have been removed. In order to prevent stalling, the front wing has been provided with quite a great angle of attack by placing a small wing and elevator in front of it. There are three wheels to the craft—one in front of the centre of gravity to prevent capsizing. Brakes allow one to stop the plane within a short distance. The plane, which the constructor has named "The Duck," fitted with two Siemens motors, each rated at 100 horsepower, is said to possess great climbing power, and to be able to fly at the rate of ninety miles per hour. When in the air, it appears to be going backwards.

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Ship-to-Shore Airmail Service

THE *Europa* is upholding her reputation. She is not contented with having established the world record of four days, seventeen hours and six minutes on her maiden voyage from Cherbourg, France, to Ambrose Lighthouse, off the Jersey Coast. She's saving half a day now in the delivery of mail.

Recently the *Europa* was equipped with a mailplane, the *Atlantic,* which accompanies the giant steamer on all its trips. In order to improve on the existing system of landing mail, the *Atlantic* is catapulted from the ship, about a hundred kilometers, 62 miles, before the boat reaches the harbor. Perhaps the ship-to-shore service will soon be extended to expedite the landing of passengers to whom time is an important factor.

The Style in Light Aircraft

USING an old Indian motorcycle motor as an engine, Mr. Frank Burt, of Clementon, New Jersey, has introduced the latest in light aircraft—his rowboat plane. The photograph shows the designer and inventor in his craft, which he has named *The Spirit of Clementon.* Unlike the famous *Spirit of St. Louis,* on its initial tests this rowboat plane proved a disappointment, and refused to ascend into the air. It is reputed to attain a speed of thirty-five miles per hour over the surface of the water. It has a wing spread of twenty-one feet. Another one of the flying flivvers gone wrong.

Frank Burt, amateur rowboat-plane builder, all set for his "Spirit of Clementon" to rise above the surface of the water. It couldn't be coaxed.

Monkey-Business in Iron

IRON pipe has been put to a multitude of uses; but here's a first-of-its-kind development that has them all beat for novelty. According to the *Ingot Iron Shop News,* the population of the monkeys at the Zoological Gardens in Cincinnati, Ohio, increased beyond expectations, and it became necessary to expand the living quarters of the apes. It would have cost a huge sum to build new houses and cages, so a nearby island was put into use. Here the monkeys frolic, getting the benefit of fresh air and sunshine, unmolested.

In order that they might travel at will from the cages to the island, it was necessary to construct an underground tunnel. An iron culvert, four feet in diameter and thirty feet long was built, connecting the island to the mainland.

Sunlight-Treated Bread and Cake

ULTRA-VIOLET rays for health . . . why not for furthering health, though indirectly, by making the quality of food better?

At the Bakery Exhibition in London, one of the most popular booths proved to be the one where the use of ultra-violet ray for lightening and whitening bread and cake doughs was being demonstrated. All that is done, as you can see from the illustration, is to allow the artificial sunlight to pour down upon the uncovered batter for a definite time. As a matter of fact, artificially produced rays are being experimented with to produce a whole new series of health foods. So far tests have been very successful. Ultra-violet rays have the property of producing very necessary vitamins and are in themselves very germicidal.

Who Couldn't Keep Cool?

THOUGH it's a little late to think of sunparlors for those of us who live where fur coats and heavy clothes hold sway, we can think of next summer, or can imagine we're in Florida or California, when we look at this picture. The charming young lady examining the roof of this bungalow is Miss Mae Reid. The bungalow is on top of the Sherman Hotel, Chicago. It is equipped with a unique cooling system—sprays of cool water constantly flow over the skylight. Yes, it's leak-proof.

We don't know how practical this new way of lowering the temperature would prove for the usual home or apartment house . . . and incidentally, how expensive. Suppose you try it when the hot weather sets in.

Relics from 10,000 B. C.

AMERICAN archeologists excavating at Alishar, Turkey, in the fifth attempt at solving the Hittite mystery, have unearthed remains of the Stone Age, and discovered relics of a settlement supposed to have existed at least 10,000 years before the birth of Christ. One on top of the other, ten layers portraying distinct periods of man's development have been dug up. Among the remains are the wooden roof of a dwelling occupied 12,000 years ago, valuable cuneiform tablets, fortresses, palaces, temples, jewelry, and the bones of the ancient peoples.

Should your recollection of the Hittites be hazy, they are the ancient Orientals who ruled over part of Asia Minor and Syria between 2000 and 1200 B. C. They were rivals of the old Egyptians.

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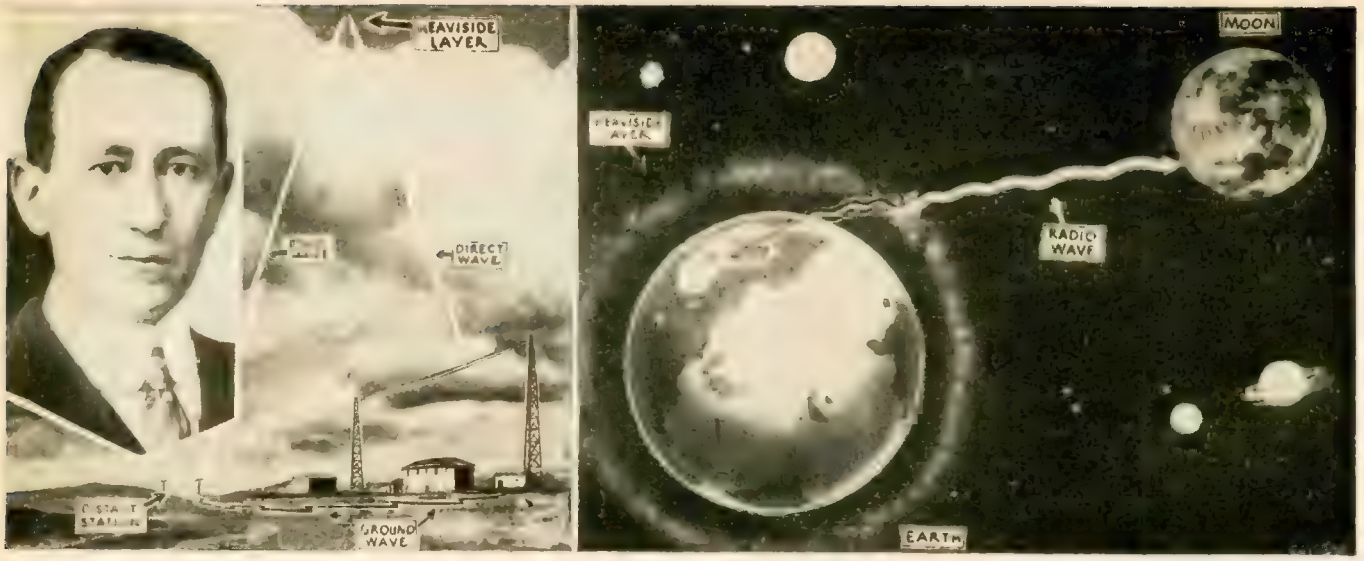

Exploring Outer Space by Radio Beams

ABOUT two years ago a Danish experimenter named Hals began to observe radio echo signals which arrived much later than one-seventh of a second, the time taken for previously observed echo signals to travel completely round the world. Hals' first observations detected echoes which arrived several seconds after the original signal. Two Scandinavian scientists, Störmer and Pedersen, took serious notice of this discovery, and commenced investigations, with the result that eventually they were able to detect echoes arriving as much as twenty and thirty minutes after the original signal. These discoveries seemed to indicate clearly that, contrary to general belief, short waves *do* penetrate the Heaviside Layer and travel for millions of miles in a straight line into outer space until reflected back again to the earth by planets, or by other ionized layers far away in outer space. In the course of a recent address before the Italian Society for the Advancement of Science, Marchese Marconi (inset above, left) said that the waves are reflected by bands of ions outside the magnetic field of the earth, sometimes at a distance from the earth of 25,000,000 miles, and observations by Hals indicated distances up to 48,000,000 miles. The illustration shows, at left, the two kinds of waves we are familiar with, the ground wave, and the space wave which is reflected back to earth by the Heaviside Layer. At right is the new "celestial wave"—if we may call it so—which penetrates so far into outer space. Marconi suggests that further ultra-short wave development, plus ultra-sensitive modern receivers, may reveal to us further valuable information concerning our neighbors in the solar system.

British Flying Boats Cruise Baltic

THE photograph shows one of Britain's flying boats, known as the Super-marine Southampton type, with Group Captain E. R. C. Nanson in command, about to take off from Calshot, near Southampton, England, on a cruise over the Baltic. This type of flying boat, which first appeared in 1925, is now the standard twin-engined reconnaissance flying boat of the Royal Air Force. Similar machines are in use by the Royal Australian Air Force, the Imperial Japanese Navy, and the Argentine Navy. During 1927-28, four metal-hulled "Southamptons" of the Far East Flight, R.A.F., proved their worth in a flight from Plymouth to Singapore, thence round the continent of Australia and back to Singapore, where they are now based. This cruise, which totalled 23,000 miles, was carried out to schedule without trouble of any kind. These twin-engined machines seat five, and are of the equal-wing, unstaggered biplane type. The normal structure of the wings is of wood covered with fabric, but metal wings have been produced which are approximately 200 pounds lighter than the wooden ones, with which they are interchangeable. Two 470 H.P. Napier "Lion" engines are fitted.

Germans Use Duralumin Boats

FROM Gruenberg, Silesia, comes the news that the German army, in an effort to secure still greater mobility, has substituted a new type of boat for the usual heavy army pontoons or pontoon bridges. The new invention consists of a peculiarly constructed boat made of duralumin which can be folded up for easy transportation over land. It has accommodation for a dozen men, and is used for patrolling or crossing rivers.

Above—Soldiers unfolding the new boat ready for launching. Right—Soldiers paddling the boat across a river.

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From Piano Stool to Book Table

By H. L. Weatherby

Director of Manual Training, Montgomery County Schools, Montgomery, Alabama.

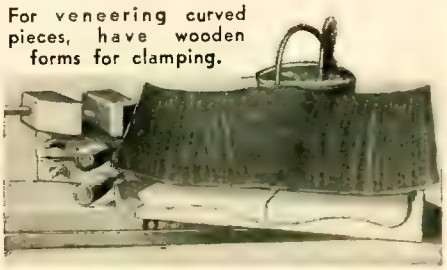
Clamping the veneer on the uprights.

FOR the lazy person of literary tastes there is no article of furniture that will quite equal a revolving book table, or a drum table as it is usually termed. One can have a whole library at his finger tips, with a variety of reading to suit all moods and without rising from his chair. At the same time, if the reader be a smoker, he has a convenient place for cigarettes and ash tray on top of the table.

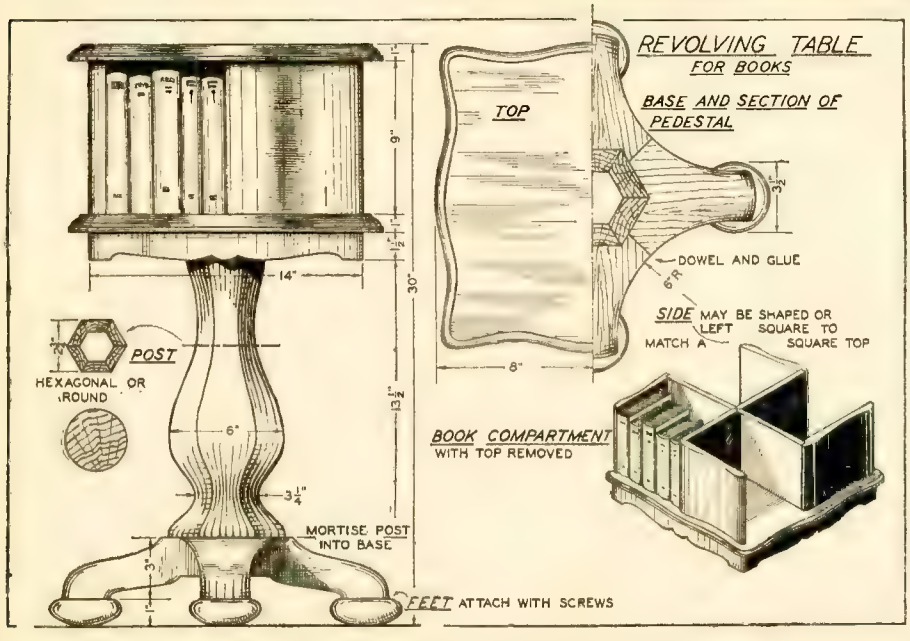
Tables of this type are also often used as convenient display places for the choice small vases and other articles of like nature around the home.

The table illustrated here was built from an old piano stool made in that style of our grandmothers' day, which is becoming so popular again. There are a great many of these old stools no doubt, similar in type, which have long since given way to the more modern piano bench; and which are probably lying about in attics and storerooms, of no further use to anyone. We suggest that you get the old revolving stool out, tear off the remnants of upholstery, clean off the old varnish and add the book compartments to the top and see what a truly useful and beautiful article of furniture will be the result of your labors.

Lacking the stool to begin with the craftsman can fashion the whole thing in his home work-shop and arrive at the same end, after a little more labor and time have been spent in construction.



For veneering curved pieces, have wooden forms for clamping.



These detailed drawings give all the necessary constructional data. The exact measurements will have to be altered to suit different piano stools which individual readers may have around the place and decide to convert.

Only very general dimensions are indicated on the drawings. It was felt by the writer that each individual would have to suit the construction to his own type of piano stool, and for that reason explicit directions could not be followed. A few general directions, however, will be offered.

After the old upholstery has been removed, clean up all varnished surfaces, using a good paint or varnish remover. It may be necessary to patch broken places with small pieces of veneer. Stick shellac may be purchased in dark colors, melted, and run into small cavities like sealing wax, and will be a very good patching agency. This is smoothed over after it hardens.

Construction of the book compartments will probably be the next step. The two tops are identical in shape and the edges may be shaped at the local mill, or simply rounded off by hand. The shape of these tops should probably conform to the general shape of the original rail, although in most cases they would look alright if made up square with rounded corners. The same is true of the upright pieces. These should probably be made solid, but they may be cut from soft wood and veneered as illustrated. For anyone who has never tried veneering, he will find the job an interesting one, and beautiful grain can best be secured in this manner. Veneer (*Continued on page* 844)

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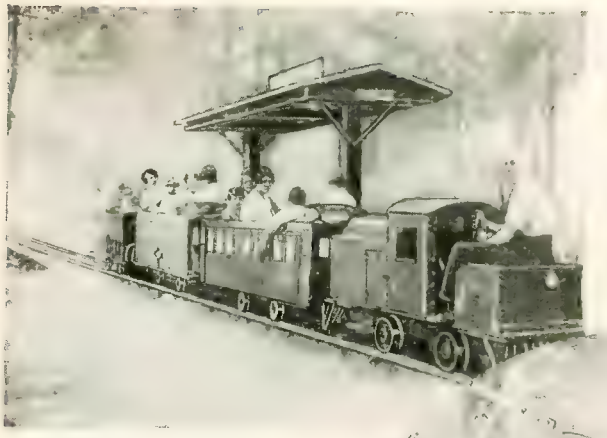
He Can't Miss His Train

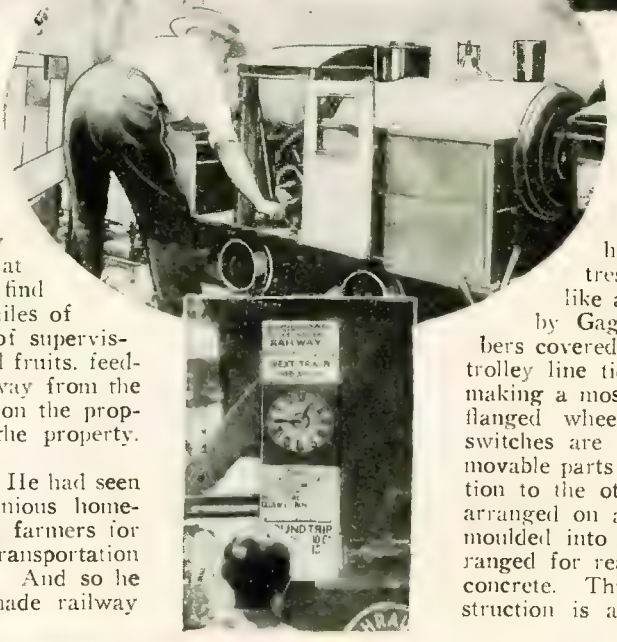
Broker-Farmer Builds and Operates His Own Railway System for Pleasure and Profit

By Austin C. Lescarboura



Left — A passenger train stops at Cecilwood Park.

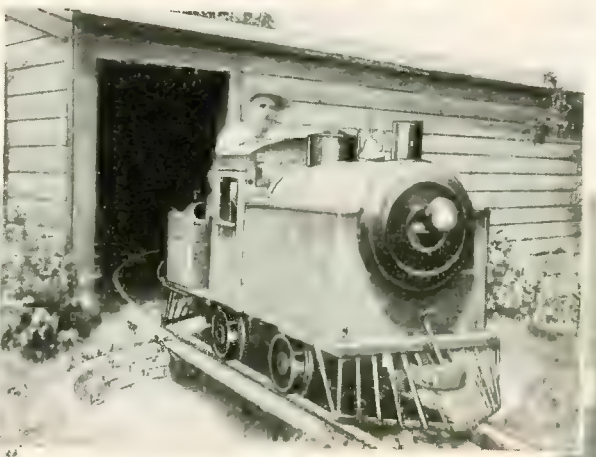
Right — Flat cars are provided for hauling tools, produce and feed. Below — Cranking up his motor.



THE city dweller, accustomed to subways, elevated trains and street cars, is certain to miss his transportation facilities when transplanted to a many-acred farm. Distances are great and legs undeveloped. So it was with W. C. Gage, a New York City broker, who retired to his farm at Fishkill Village, N. Y., only to find that acres of land meant many miles of walking each day in the course of supervising, bringing in the vegetables and fruits, feeding the chickens, carting ashes away from the house and bringing them to fills on the property, and taking friends about the property. What to do?

Gage had travelled extensively. He had seen many things, among them ingenious home-made railways in Europe, built by farmers for the purpose of providing ready transportation in the absence of costly flivvers. And so he conceived the idea of a home-made railway for his farm. In a dozen years it has grown from a thing of utility to one of rare beauty, from an expense to a profitable investment. Originally intended for the routine of the farm, the railway has become a real attraction to many tourists. Like all good railroads, it handles both freight and passengers.

The Cecilwood Vest Pocket Railway boasts of two miles of track, winding through gardens and open country, passing through woods, running alongside a brook and swimming hole, crossing over bridges and trestles, and, generally, behaving like a real railroad. The track, built by Gage, consists of two-by-four timbers covered with strip iron and laid on old trolley line ties cut to half the usual length, making a most substantial track for the small flanged wheels of the rolling stock. The switches are of the simplest form, with the movable parts arranged to slide from one position to the other. Most of the switches are arranged on a concrete bed, with fixed parts moulded into place, and the sliding parts arranged for ready movement over very smooth concrete. Thus intricate metal or wood construction is avoided, and everything is kept strictly on the home-made basis. The railway includes such standard features as bridges and trestles, which are built of four-by-four timbers for short spans, and six-by-six timbers for long spans, giving ample strength for safety. (*Continued on page* 842)



Centre—The Cecilwood Vest Pocket Railway even has a real depot. Above—There is a round-house for the locomotives, and a turntable to turn them around. Left—A section of the track. Right—This useful little railway even runs right up to the house, ready to take you out.

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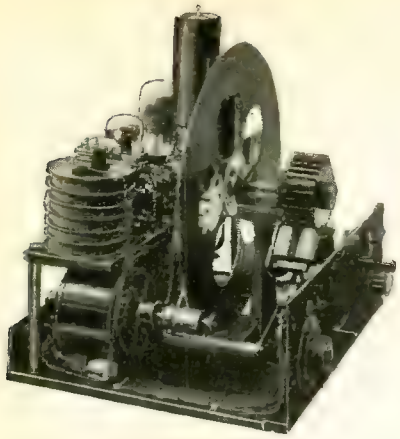
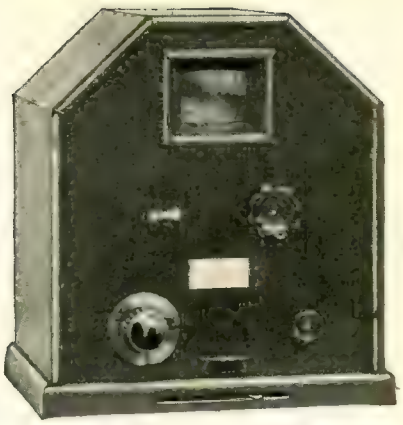


New universal televisor for German and English broadcasts, incorporating Mihaly's latest developments.

Television in Germany Today

By Dr. Alfred Gradenwitz



Standard televisor developed by Fernseh, A.G., incorporating the patents of the British inventor, J. L. Baird.

Night view of Witzleben Tower, Berlin. On top is an aviation beacon and observation gallery. One third of the way up is a restaurant. The tower supports the aerial of the Witzleben broadcasting station. Below the tower can be seen the stepped roof of the Radio Exhibition building, which housed the television apparatus.

AT the 1930 Berlin Radio Exhibition Television showed that certain advances have been made in its proper field during the past year. Progress in visual broadcasting has gone apace, some of the difficulties of radio transmission having now been overcome. The quality of images is now practically all that can be expected under the present regulations. In fact, no marked further progress can be expected before the advent of short-wave or, even better, ultra-short wave television broadcasts, enabling a relatively larger number of picture elements to be transmitted through the air.

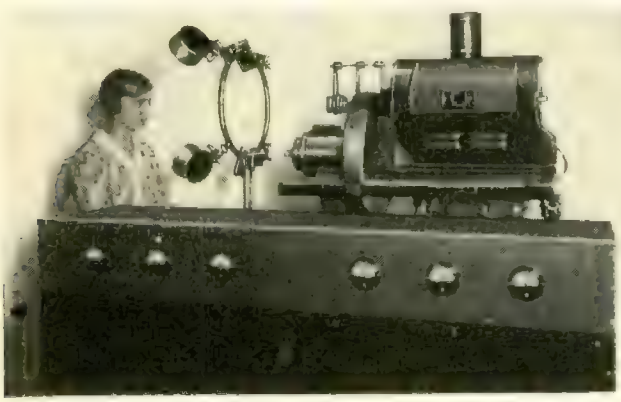
The television exhibits were housed in a special section of one of the main halls, partitioned off by curtains to secure the semi-darkness suitable for the reception. The *Reichspost-Zentralamt*, of Research Department of the German Post Office, which is sponsoring television, had the Witzleben Television Transmitter to show, from which all German visual broadcasts for the last eighteen months or so have been emanating. Moreover, there was a light-spot scanner designed for the German Post Office by the *Fernseh-A. G.*, which is the German subsidiary of the British Baird Television Company. While the Post Office television broadcasts so far have been limited to the transmission from simple films, actual television, i.e. the transmission of views of persons and of moving scenes, is now to be started.

A special feature of this light-spot transmitter was the use of a new type of photo-electric cell responding only to infra-red rays. A person seated in front of it is not inconvenienced by any dazzling light, all visible beams being eliminated by an infra-red filter, while the television studio can be illuminated by short-wave visible light. In fact, a person thus televised will be able, while seated in front of the photo-electric cell, to read a manuscript.

Another light-spot transmitter of similar design was exhibited by the *Fernseh-A. G.* in a transmitting booth of their own. It comprised a Nipkow disc with 67 holes, corresponding to 3350 picture elements, i.e., nearly three times the German standard figures. A "tele-talkie" film was demonstrated, showing the great improvement obtainable by the mutual assistance of speech and vision.

In the way of receivers, the Research Department had a Nipkow disc receiver as well as a mirror-drum receiver of their own to show, in addition to two projection receivers designed for them by the two German television companies. The *Telehor*, i.e. Mihaly, firm supplied a lens-disc screen receiver, while the *Fernseh-A. G.*, supplied a small mirror-drum receiver.

In order to show the possibilities of television unhampered by the restrictions of present ether control, some independent television systems were provided—in addition to televisors designed for (*Continued on page* 857)



Light-spot transmitter built by Fernseh, A.G., for the German Post Office. Note the extensive photoelectric cell amplifier in the foreground.

The stand of the Telehor Company at the 1930 Berlin Radio Exhibition, where finished receivers and kits of parts were exhibited.

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Model Guillotine Makes Useful Cigar Cutter

By Charles H. Alder

Anyone Possessing the Necessary Patience to Make Small Component Parts Can Easily Construct This Model With the Simplest of Tools. The Completed Model Makes an Attractive Desk Ornament and Is Utilitarian as Well

A view of the completed guillotine, showing the table on which the body is laid, and the basket into which falls the head; in this case, the cigar and the snicked end respectively.

A FRENCH physician, Dr. Joseph Ignace Guillotin, born May 28th, 1738, died 1814, has always been credited with the invention of the guillotine, but Dr. Guillotin only supported its introduction into France. Its invention is ascribed to the Persians, and may date back to the 17th century.

It received the name of guillotine officially in memory of Dr. Guillotin's suggestion that such a machine be constructed and used throughout France as a new and uniform method of capital punishment. Ironically enough, Dr. Guillotin himself was a victim of the machine which bears his name.

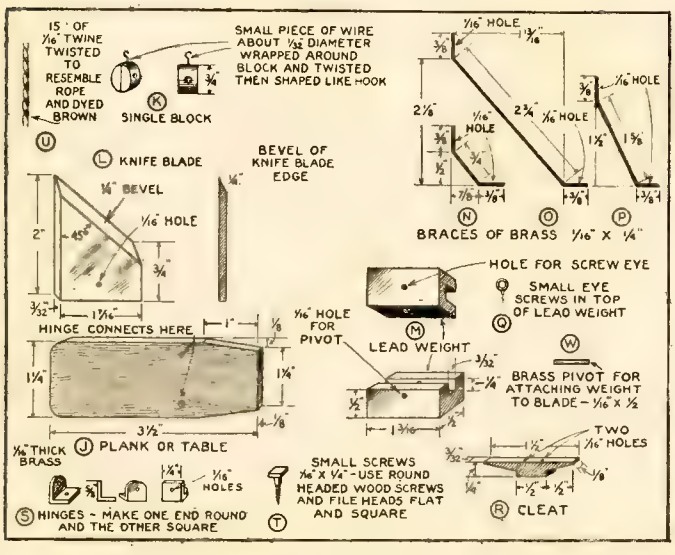
The guillotine was first introduced during the French revolution, and its first victim is said to have been a highwayman. For a time its use was limited to people of noble birth, as it was considered the most agreeable method yet evolved for carrying out the death penalty.

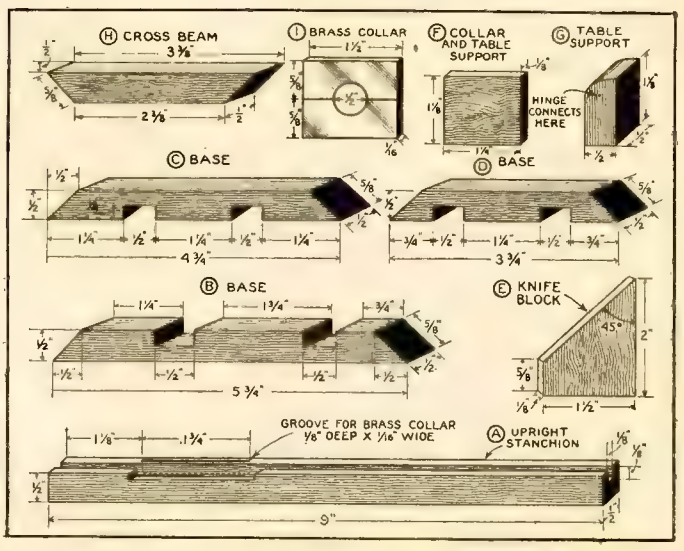
A model guillotine, besides being an interesting thing to make, and a unique ornament when finished, can also be made to serve a useful purpose as a cigar cutter. The tools required are available to almost everyone. You need a hack saw, a wood saw, a pocket knife, a small flat file, pliers, screw driver, ruler, hammer, small brush, hand drill, and an improvised mitre box.

The material required is four feet of ½" square white pine, bass wood, box wood, or any straight grained wood. This will make the upright stanchions, base, cross beam, and plank or table support. A cigar box lid or similar piece of wood ⅛" thick will do admirably for the table, collar support, knife block and the cleat. An old ruler does very well for these parts. The base for the model measures 8⅝" ×6¼"×½", and may be made of white pine, oak, or any other wood that will take a nice finish.

The guillotine in operation as a cigar cutter. The cigar is held on the table, the knife pulled up to the top, and released. In falling, it snicks off the end of the cigar.

To make the braces there will be required eighteen inches of strip brass, ¼"×1/16". The hinges can also be made from this strip brass. The collar, shown at I, is made from sheet brass 1/16" thick. Some round-head brass screws will be required, size 1/16" in diameter by ¼" long. A piece of lead 1 3/16" ×½"×½" will (*Cont'd on p.* 837)


15' OF 1/16" TWINE TWISTED TO RESEMBLE ROPE AND DYED BROWN
SMALL PIECE OF WIRE ABOUT 1/32" DIAMETER WRAPPED AROUND BLOCK AND TWISTED THEN SHAPED LIKE HOOK
SINGLE BLOCK
KNIFE BLADE
BEVEL OF KNIFE BLADE EDGE
1/4" BEVEL
1/16" HOLE
HINGE CONNECTS HERE
1/16" HOLE FOR PIVOT
BRACES OF BRASS 1/16" X 1/4"
HOLE FOR SCREW EYE
SMALL EYE SCREWS IN TOP OF LEAD WEIGHT
LEAD WEIGHT
BRASS PIVOT FOR ATTACHING WEIGHT TO BLADE - 1/16" X 1/2"
1/16" THICK BRASS
PLANK OR TABLE
1/16" HOLES
HINGES - MAKE ONE END ROUND AND THE OTHER SQUARE
SMALL SCREWS 1/16" X 1/4" - USE ROUND HEADED WOOD SCREWS AND FILE HEADS FLAT AND SQUARE
TWO 1/16" HOLES
CLEAT



These detail drawings give all necessary information for the construction of the component parts.

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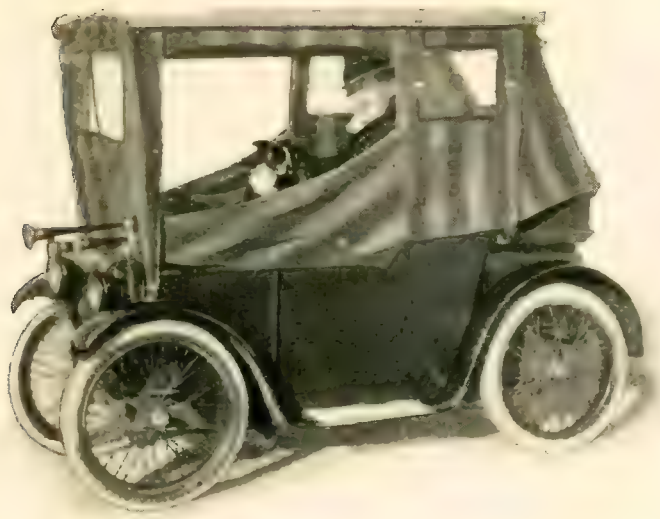
He Rides a Hundred Hobbies!



The Colonel tours his estate in a specially designed electric car, which is practically a mobile office.

By William T. Miller

Colonel Green, Not Satisfied With Amassing Mere Millions, Has Converted 250 Acres Overlooking Buzzard's Bay Into Scientific Laboratories and Fields. Here He Spends Most of His Time Doing Research Work in Any of His Hundred Hobbies — Aerodynamics, Radio, Television, Electricity, and Photography.

ON the sand dunes, at South Dartmouth, Massachusetts, where Cape Cod begins, 250 acres overlooking Buzzard's Bay have been transformed into a veritable paradise for those who crave scientific research. Here Colonel E. H. R. Green rides his hobbies, and, aided by scores of eager helpers and associates, pursues interesting and novel experiments in aerodynamics, radio, television and radio movies, electricity, and photography, and carrying out his youthful desires.

As a boy, Edward Howland Robinson Green wanted to know "what made the wheels go round," but he placed the material necessity of achieving a success in life ahead. The son of Hetty Green, one of the shrewdest and most capable business women America has ever produced, Ned Green early proved himself capable of conquering his share of the world of business and finance. Meanwhile, his interest in mechanical development and technical research kept pace. He drove one of the first automobiles to be used in the State of Texas. He owned a railroad, and when he found that one of his employees, the movie pioneer, Lubin, was working with motion pictures, fell in wholeheartedly with the experiments which made early thrillers possible.

To aid him in scientific work, Colonel Green has constructed buildings and laboratories and filled them with the most up-to-date equipment.

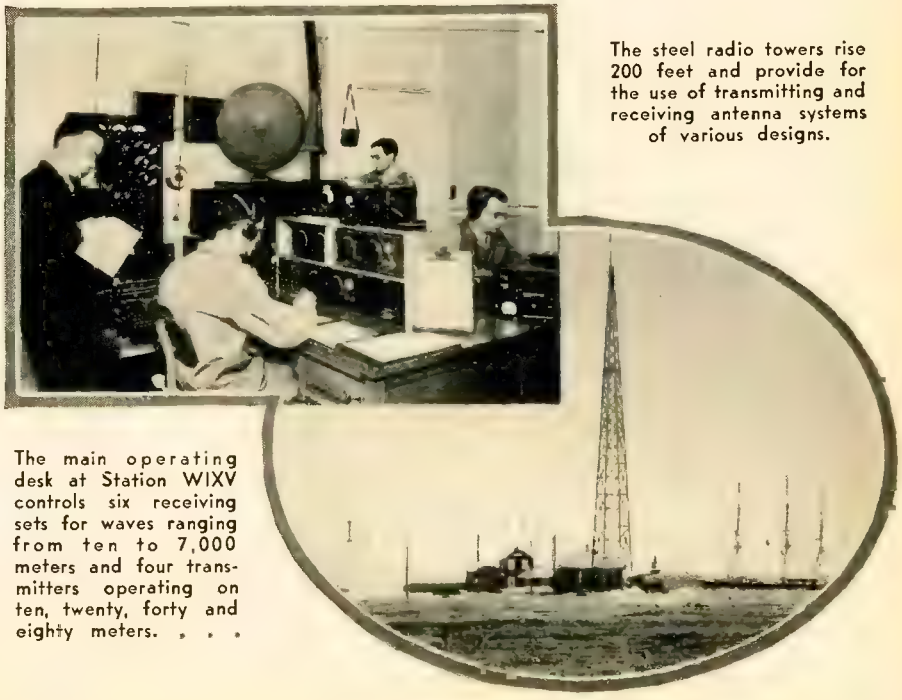
One of the Green buildings is a powerful private radio station (WMAF). Here pioneer experiments in "land wire" transmission and rebroadcasting of programs were made. Community center amplifiers have been developed. A complete motorized radio receiving and amplifying apparatus is available for "field experiments."

A tract of marsh land of ample size has been filled and leveled to form an airport. Here, last summer, a commercial dirigible made meteorological experiments in connection with the Massachusetts Institute of Technology. In the bay nearby, a breakwater has been built to afford safe landing of seaplanes. Experiments are conducted with various radio devices to aid aviation. A laboratory for fog research has been built as well as a short-wave radio research station (W-IXV).

There is also a photographic laboratory. Work with telephoto lenses has been developed to the point of obtaining clear pictures of objects five and even ten miles distant.

One of the most interesting devices on the estate is Colonel Green's own electric automobile. This car is practically a mobile office; in addition to a compartment for note books and a folding table for writing facilities, it carries a radio receiver using a loop antenna on the rear of the car.

Colonel Green's hobbies are varied. He is a philatelist as well as a scientist, and owns one of the most valuable stamp collections in the world. And the flowers and gardens which surround the Green mansion are as widely admired as are the results of his achievements in other fields. His estate exhibits only a part of what he has accomplished.



The steel radio towers rise 200 feet and provide for the use of transmitting and receiving antenna systems of various designs.

The main operating desk at Station WIXV controls six receiving sets for waves ranging from ten to 7,000 meters and four transmitters operating on ten, twenty, forty and eighty meters. . . .

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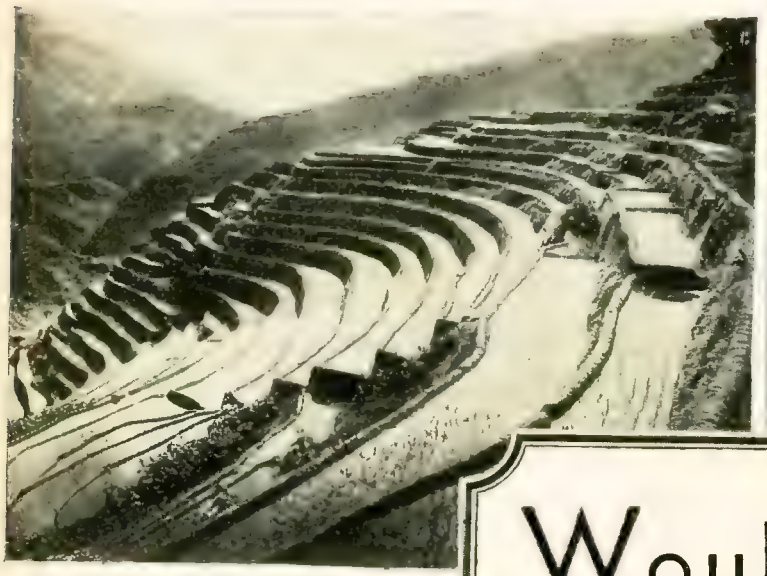
WHOLE mountainsides covering more than 100 square miles have been cut away to make stone faced terraces that provide flat land for the cultivation of rice. These terraces are outstanding examples of engineering feats of people who lived more than a thousand years ago. They belong to the Ifugaos, one of the hill tribes of Luzon, Philippine Islands.

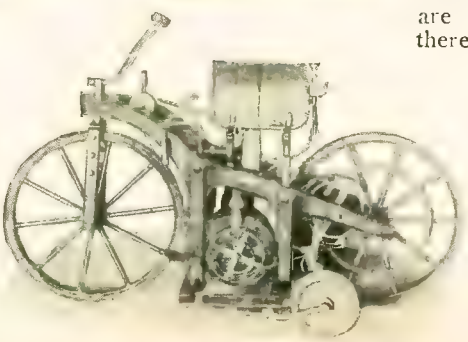


Would You Believe It?

The 1897 Auto

CHARLES E. DURYEA, a pioneer in the American automotive field, is photographed here with the fourth Duryea design, which was recently placed on exhibition at the Museum of Peaceful Arts. This car designed in 1897 was built two years later. It has a three-cylinder engine which develops 35 horsepower when it runs at 3,000 revolutions per minute. The car had a planetary transmission and was capable of a speed of 30 miles an hour. In 1900, John Graver, of Pennsylvania, purchased the car. He used it for 10 years and then let it stand in the open for 20 more. Mr. Duryea bought it again and turned it over to the museum.

ANOTHER automobile of rare vintage is one that was purchased by Henry Ford, in Munich, Germany. It looks more like an ancient motorcycle than an auto. Nevertheless, the reports state that it is actually a model of an 1888 Benz, a product of Karl Benz. The automobile on display in the German Museum is supposed to be the first one built in Germany and dates back to the year 1885.



What Is It?

YOU have undoubtedly produced this effect thousands of times but never realized it. The next time that you put a silver spoon in a tumbler of water observe the tiny air bubbles that arise from the spoon and gradually reach the surface of the water in the tumbler. This photograph was taken a moment after the spoon was dropped into the water.

Not a Freak of Nature

WHAT seems to be the huge sea serpent in this rather striking view, is merely the bony skeleton of a huge Australian python. The leg-like structures are really the ribs.

The Forerunner of the Saxophone?

NATIVES of La Messa Angat on the island of Luzon, one of the Philippines, claim that the modern saxophone was copied from the bamboo instruments of their forefathers. These musical constructions are still in use there.

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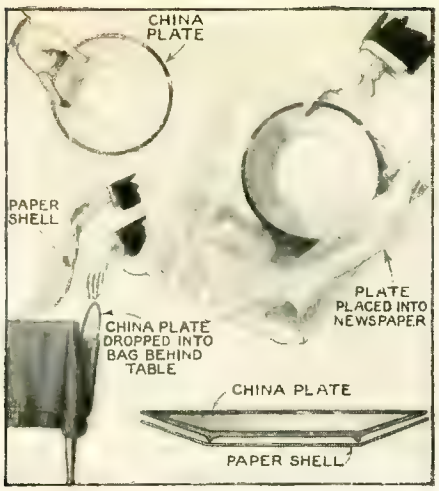
MAGIC

The master mind of modern mystery, who has mystified Ex-Presidents Harding, Taft, Roosevelt, Coolidge, the Prince of Wales and other celebrities, presents another of his magic series.

By Thurninger*



The Vanishing Plate

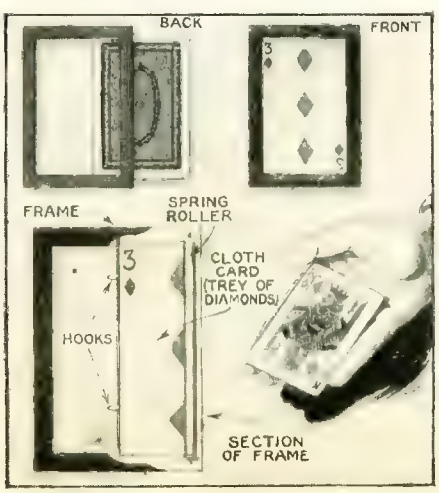
A CHINA plate is shown to the audience and its substance and solidity is tested by striking it with a wand. Without any cumbersome moves, the plate is tightly wrapped in a sheet of newspaper. The wizard now tears the paper parcel into fragments. All traces of the plate have vanished.

Secret. Beneath the china plate is one of paper, which has been entirely covered with white enamel. In the act of picking the newspaper off the table, the genuine plate is secretly slid into a cloth-bag, the serviette, hung behind the table. It is the paper plate which is wrapped in the paper sheet.

Transformation Frame

A CARD is freely chosen from an unprepared pack that has been presented to a spectator, face down. With its face still down, the card is slid into the side of a small frame just large enough to hold it. The magician explains that this is done to prevent substitution. The frame is now turned over so that the audience can see the face of the card, which we will suppose is the trey of diamonds. The frame is now presented to some spectator to hold. With the back of the card toward him he is instructed to slowly withdraw the card. When he does so he finds that he has a king of diamonds instead.

Secret. The card which was originally placed in the frame, was the king of diamonds but when passed through the slit in the frame the edge of the card caught two small hooks which drew a cloth card into place, and covered the face of the originally chosen card.



The International Bullet

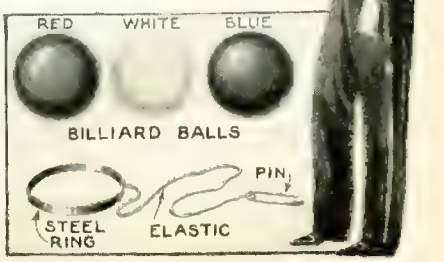
A LARGE metal gun-cartridge, 18 or 20 inches high is shown to the audience. The top portion of the bullet is merely a thin shell unquestionably empty and unprepared. The lower tubular section of the supposed implement of war is held up so that the audience can see through it. The magician puts the top on the cylinder, then reaching down into the bottom, he removes a large quantity of silk flags.

Secret. The trick can be found in the construction of the lower section of the bullet. This is really composed of two tubes, one within the other, the inner one being tapered slightly toward the bottom. When the tube is held up for examination, members of the audience cannot observe the taper. It is in this space between the two cylinders that the flags (which should be of thin China silk) are concealed.

Patriotic Billiard Balls

THREE billiard balls, approximately 2 inches in diameter, are passed for inspection. They are perfectly round and seem to differ only in respect to color. The magician is securely blindfolded and then any one of the three colored balls is placed into his palm, held behind his back. Within a moment the magician calls the color of the ball he is holding. The trick is repeated as often as it may be desired and in any stage of the experiment the sphere may be examined.

Secret. The balls vary but slightly in size. This difference cannot be detected by the naked eye. The red ball is smallest, the white slightly larger and the blue the largest. Concealed beneath the magician's cloth is a round steel ring attached to a pice of elastic. When the magician receives a ball from a spectator, he tests it with a ring. If the ball passes through the ring it is red, if it fits snugly it is white. The blue ball does not pass through at all. When the steel ring is released it flies up beneath the coat. By applying several coats of enamel, the diameter of three balls of the same size can be varied sufficiently.



*No. 88 of a series of articles on magic appearing monthly.

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New Ideas for the Owner and Driver

By Arthur George

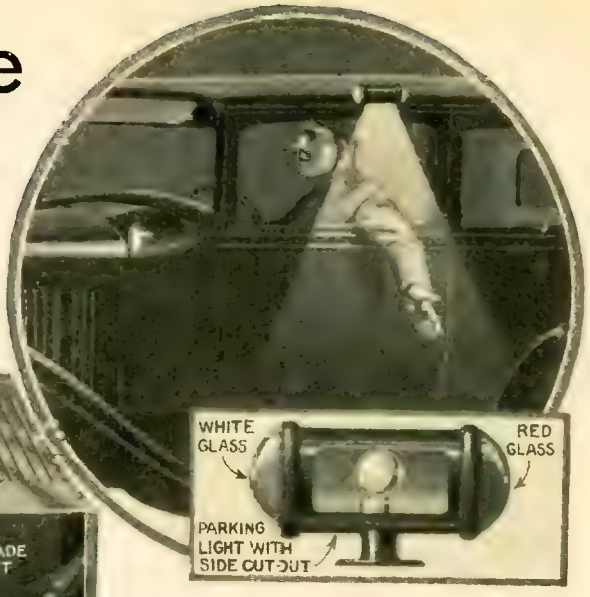
Consulting Engineer

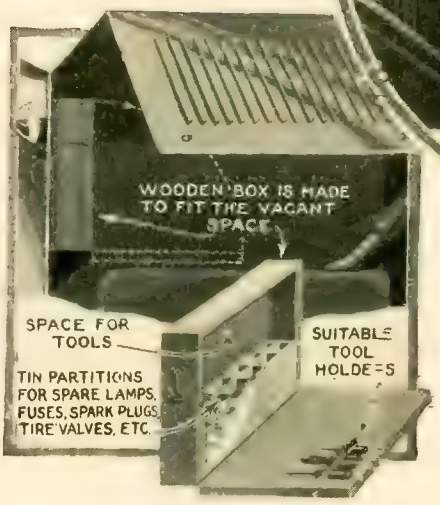
THERE are several improvements that every autoist would like to make in his car to enhance its appearance, to add to the comfort of its occupants, and to insure greater safety in its operation. Five suggestions which we have found practical and of which you can take advantage are detailed below.

Attach a slightly modified conventional type of parking light above the left side door, in such a manner as to cast a bright light downward. The red and white ends of the lamp are undisturbed, and the device serves the dual purpose of making hand signals visible and marking the car with a white light to the front and a red light to the rear for night parking.

Such a fixture can be put on the car by the mechanically inclined owner or any automobile mechanic.

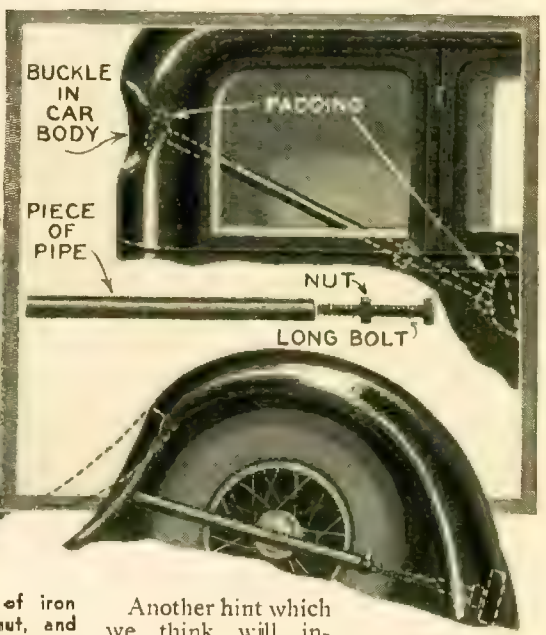
As there is considerable vacant space under the hood, the owner who mounts a compact tool storage box similar to the one sketched saves himself the trouble of removing the rear seat to avail himself of the tools which he most frequently uses for minor repairs. The box is very easily built; two bolts hold it to the dashboard and the top is hinged and kept in place by hooks. This is a very convenient arrangement, as the implements and small spare parts are at all times easily accessible. Small metal compartments for these accessories make this a very valuable addition to any car.



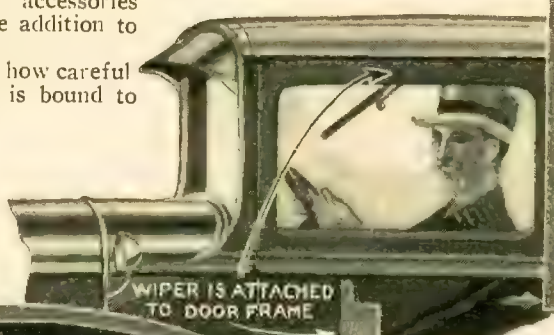

WOODEN BOX IS MADE TO FIT THE VACANT SPACE
SPACE FOR TOOLS
SUITABLE TOOL HOLDERS
TIN PARTITIONS FOR SPARE LAMPS, FUSES, SPARK PLUGS, TIRE VALVES, ETC.

Installing a modified parking light over the front left-hand window. To the left—a wooden tool box can be put in the unused space under the hood.

Every driver, no matter how careful at some time or another is bound to dent the body of his car. This most discouraging damage can be readily repaired with a home-made tool consisting of a piece of pipe, a long bolt, and a nut. Quick repairs can be made, leaving the car body without visible evidence of the previous damage. A long pressure screw jack, as illustrated will frequently restore similar buckles to their original contour without spoiling the paint. This tool is also suitable for reshaping fenders which have become smashed in parking or by slight collisions. The screw and extension merely serve as means to apply force to the dented spot. To avoid bruising the metal a padding of rags or wooden blocks should be interposed between the ends of the implement and the car body.

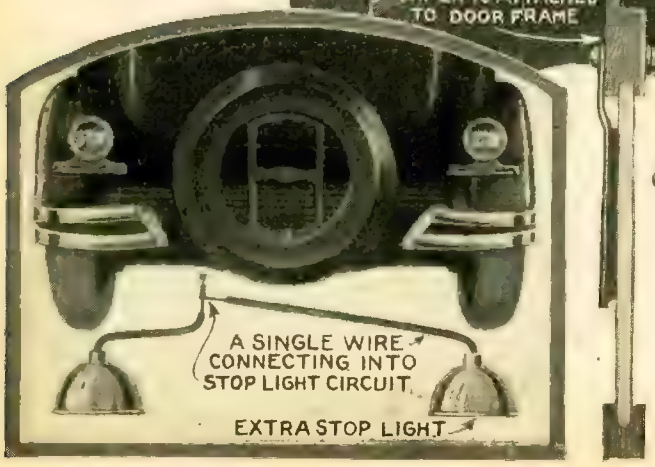


A piece of iron pipe, a nut, and a long bolt, are the requisites for making this efficient buckle eliminating tool.



Clear side vision in any weather is assured by this unusual use of the usual auto wiper, attached to the window frame.

Another hint which we think will interest you is particularly timely—good for winter driving. A hand windshield wiper, fastened on the door frame just above the center of the glass, keeps snow and sleet from your left front window. With the movement of the hand, the glass can be cleared and approaching traffic observed although the window is closed. This adds to the safety of the driver and he is not inconvenienced by being forced to frequently open the window. Such a wiper can be readily (*Continued on page* 844)



An additional stoplight can be connected to the original stoplight circuit by a single wire.

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You'll Have to Sprint to Get Your Share of that $3250.00

in Fine Tools and Shop Equipment

Contest Closes December 24, 1930

IF YOU HAD $50.00, or $200.00, or $400.00 to spend in equipping a home workshop, what tools and equipment would you buy?

SCIENCE AND INVENTION will award $3,250.00 in fine tools and home workshop equipment to the fifteen people who answer this question most effectively.

There are three points to consider —quality, completeness, amount of money allowed.

Your problem, in a nutshell, is to balance quality against completeness, and both of these points against the amount of money allowed. . . . The fifteen prizes, totaling $3,250.00 in fine tools and workshop equipment, will go to the fifteen people who tell us how to get the most and best tools and equipment for the amounts of money named in the three price divisions. You may enter lists for any or all the divisions.

Each winner in the contest will receive exactly the tools and equipment he has named in his winning selection. . . . If, however, his winning selection duplicates tools or equipment he already owns, we shall be glad to substitute any others he may desire in their place, provided the cost is the same.

Thirty-five thousand hardware dealers have been informed about this Contest. They will be glad to cooperate with you in selecting your Ideal Home Workshop.

THREE DIVISIONS—FIFTEEN PRIZES

5 at $50.00

In the First Division, you select the ideal tools and equipment you would buy if you had $50.00 to spend.

The prizes in this division will be five sets of tools and home workshop equipment, costing $50.00 per set at the manufacturers' list price. Tools and equipment will be exactly those selected by the winners.

5 at $200.00

In the Second Division you select the ideal tools and equipment you would buy if you had $200.00 to spend.

The prizes in this division will be five sets of tools and home workshop equipment, costing $200.00 each at the manufacturers' list price. Tools and equipment will be exactly those selected by the winners.

5 at $400.00

In the Third Division, you select the ideal tools and equipment you would buy if you had $400.00 to spend.

The prizes in this division will be five sets of tools and home workshop equipment, costing $400.00 each at the manufacturers' list price. Tools and equipment will be exactly those selected by the winners.

Contest Rules

1. Entries must reach our office, 381 Fourth Avenue, not later than midnight, December 24, 1930.
2. Only one prize will be awarded to any winning contestant, but you may enter lists in any or all the divisions.
3. The contest is free and open to everyone. You need not be a reader of SCIENCE AND INVENTION to enter.
4. In case of ties, tieing contestants will receive prizes of identical worth according to the division involved.
5. Neatness of lists and pointedness of letters will count in the awards.
6. No employees of this magazine or members of their families are permitted to enter the contest.
7. The decision of the judges will be final.
8. The winning lists will be those in which completeness and quality are best combined, in the judgment of the committee, within the money limits of the divisions involved.

GET A REPRESENTATIVE GROUP of tool and equipment manufacturers' catalogues. Pick manufacturers who make tools and equipment of established quality.

Write down the names of the tools and equipment units you think would be ideal for the home workshop, in any or each of the three price classes named, together with the manufacturers' list prices. Try to make your assortment or assortments as complete as possible, within the money limit allowed. Enter lists for any or all of the divisions, as you please.

For each list write a letter of from 200 to 500 words telling plainly why you chose the tools you did. Send in the letter with the list. The letter will be considered by the committee in making the awards.

Winners in the Ideal Home Workshop Equipment Contest will be announced in the April, 1931, number of SCIENCE AND INVENTION.

We want all the data we can get on the ideal tools and equipment for the home workshop. To help you in making out your lists, we shall be glad to see that you are supplied with a representative group of manufacturers' catalogues. Drop us a line saying you wish to enter the contest. We'll do the rest.

Follow These Simple Instructions

A—List your ideal tools and equipment with manufacturers' names and list prices, keeping the total within the amount named in the division the list is intended for.

B—Write a letter of from 200 to 500 words explaining why you chose the tools and equipment you did.

Important: Machine Tools, Motors, and Miscellaneous Working Equipment Will Be Considered in This Contest

Where manufacturer furnishes consumers' discount prices, you may consider such quotations as list. Otherwise catalogue prices are list prices

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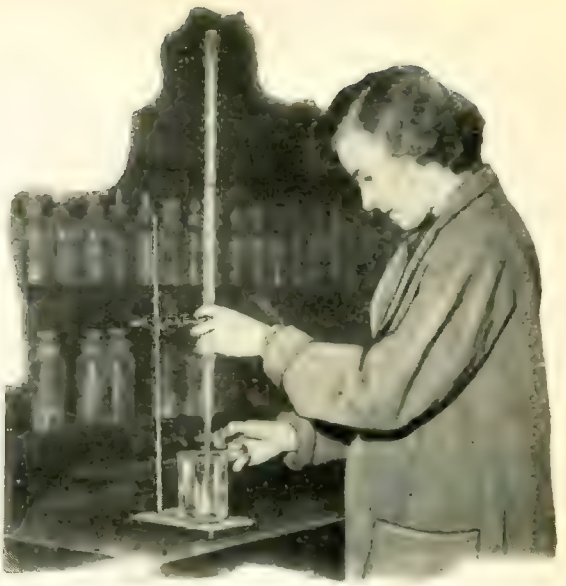
Make Synthetic Dyes at Home

Full Directions for Preparing Several Coloring Agents

By Captain Robert E. Sadtler, U.S.A.



An excess of alkali added to an acid which contains a drop of methyl orange changes the color of the solution from pink to yellow. Left—In the preparation of fluorescein, anhydrous zinc chloride is added to resorcinol and phthalic anhydride, after fusion over an oil bath.

THERE are several dyes and colored organic compounds which may be easily prepared by the amateur chemist with chemicals that are readily available and at very low expense. They are:

Methyl Orange,
Fuchsine, Aniline Red or Magenta,
Indigo,
Phenol,
Fluorescein,
Eosin.

Methyl orange is the salt of a sulfonic acid, and it is extensively employed in quantitive chemistry as an indicator. The aqueous solution has a red color when an acid is added, due to the formation of free sulfonic acid. The aqueous solution of the alkaline salt of sulfonic acid has a yellow color. These changes in color are utilized in the determination of the degree of acidity of alkalinity of solutions.

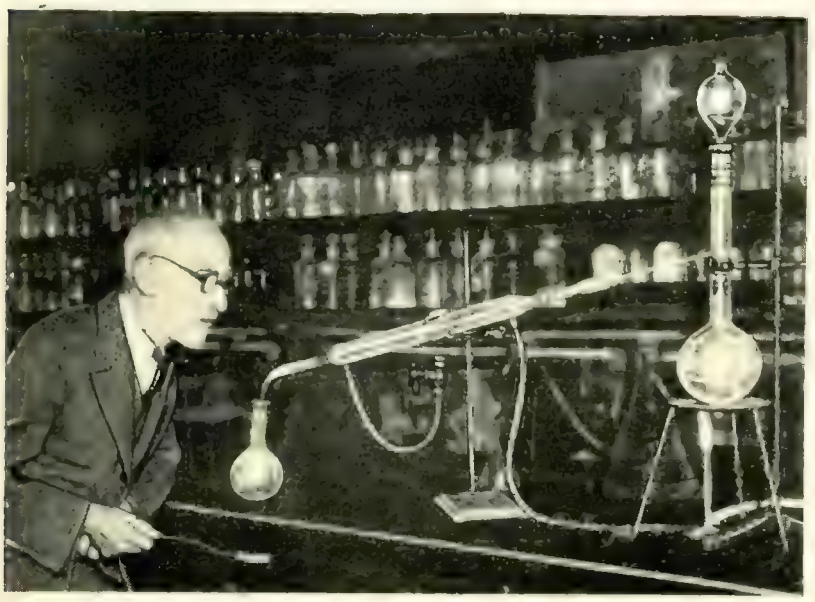
Sulphanilic acid is needed for this preparation, and in case of difficulty in obtaining it, use the following method: Pour 25 grams of aniline cautiously into 80 grams of concentrated sulphuric acid, keeping the receptacle cold during the mixing. Then heat the mixture to 180° C. to 190° C., for about 4 hours. If a small sample of the product is then dissolved in water and treated with an excess of sodium hydroxide solution, there should be no separation of aniline oil. Pour the entire cooled batch into cold water, and the sulphanilic acid will separate as a mass of gray crystals. Filter these

by suction, and wash with cold water while they are on the filter. Now dissolve them in as little boiling water as possible, shake with about 2 grams of powdered charcoal and filter. When the solution cools, the sulphanilic acid will crystallize out again, and can be left to dry.

To prepare methyl orange, make a solution containing 1 gram of sodium hydroxide in 10 cubic centimeters of water. In another small beaker, dissolve 1 gram of sulphanilic acid in 5 cubic centimeters of water and add 2½ cubic centimeters of the sodium hydroxide solution. Now place the beaker in ice and add a solution containing ½ cubic centimeter of concentrated hydrochloric acid in 2 cubic centimeters of water. The resulting solution should be reddish in color.

In a small beaker mix 0.74 grams or 20 drops of dimethyl aniline with about 13 drops of glacial acetic acid. Stir the solution prepared above constantly, and slowly add this solution. The thick, dark red mass which at once begins to separate is the dye—methyl orange. Now add the remainder of the sodium hydroxide solution and stir well. Filter this solution through two ordinary filter papers placed one upon the other in a glass funnel. The crude methyl orange prepared in this manner should now be recrystallized from 20 cubic centimeters of hot water. Then dry it on a filter paper. The methyl orange dye prepared in this manner will be in the form of leaflets having a golden luster.

Magenta may be utilized to dye animal fibers like wool or silk without the use of a mordant. It consists of a mixture of rosaniline and pararosaniline hydrochlorides. It may be prepared by treating a mixture of three parts of aniline to one of toludine with concentrated hydrochloric acid until a pasty mass results. Then add a little more aniline and an equal weight of nitrobenzene. While stirring the mass, it should be slowly heated to 190° C. when a small amount of iron fillings should be added. The water-soluble red magenta is formed in the solution as a red mass and the crystalline form may be obtained by slow crystallization.



Professor L. Henry Friedburg, Ph.D., of Hunter College, observes the distillation of the solution which forms diazobenzene sulphate, from which phenol is made.

Photos specially posed by Hunter College. By Charles Curtis, Inc.

The procedure followed (*Continued on page* 855)

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Scientific Aids to Comfort

By Mary Jacobs

A Sunless Coat of Tan

MOST of us can no longer bask in the sun to acquire a fashionable coat of tan—and, incidentally, get the benefits of the health-giving ultra-violet beams radiated from the sky. Here's an artificial sunshine producer that will give us the same tonic and stimulating effect as Nature. This inexpensive, carbon-arc lamp is portable and can be put on the floor, on the table—in any position that you may desire for use. If it is your back that requires treatment, put it on a low table; if it's your throat, put it on your dresser. This lamp can be used safely. It shuts off automatically after four minutes.

Don't Burn Your Hands

HAVE you ever tried to lift sizzling doughnuts from a pot of steaming fat with a fork? To turn a roast of meat, or a potato, in the oven? If you have, it's a foregone conclusion you have not only succeeded in doing these things, but in simultaneously burning your hands and singeing your arms. Tongs of cold rolled steel, impervious to heat and cold, can be used to help you in cooking, baking, dyeing clothes and removing bottles from steaming pots. They come in three sizes, six inches, nine inches, and twelve inches, according to the purposes for which they are intended.

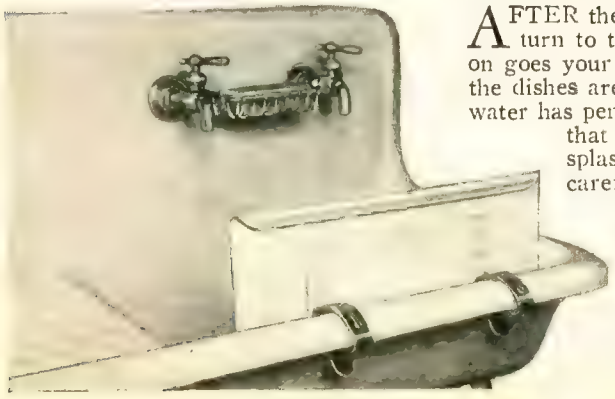
Potatoes That Peel Themselves

YOU no longer need a paring knife to peel potatoes—a tedious, messy job with one. Slip them on the spindle of this automatic peeler, release the cutter arm, and turn the handle. In a few seconds your potato will be pared evenly, for the machine is so adjusted that it will cut the same fine wafer-like strip from the entire surface, regardless of how irregularly shaped it may be. The device can also be used for making finely cut garnishes for salads, to cut carrot, beet and apple strings for decorations, and to peel turnips and other vegetables that are not very soft.

Turning the handle peels the potato.

Much Needed Protection

AFTER the party is done and you return to the kitchen to wash dishes, on goes your apron. How often, after the dishes are washed, do you find that water has penetrated to your dress? Or that the spotless floor is all splashed up, in spite of your carefulness? By using a sink protector you can keep your dress fresh without benefit of an apron, and the floor dry. It is easily adjusted to any sized sink and can be pushed down into the sink when not in use.



Nested Glassware Sets

HERE'S a set of pyrex glass containers that serves three distinct purposes—you can cook your food in them, serve it from them, and store whatever is left over in the refrigerator. As they nest in one another, a minimum of space is required. The dishes come in graded sizes—small individual casseroles for storing butter and little left-overs; larger ones for cooking fruits and vegetables, and still larger containers for baking cakes and meats.

Eggs as Wanted

EGGS cooked just to your individual taste—soft, medium or hard—time and time again, without trouble. And all you have to do is to adjust the indicator at the top once, before putting them on to boil. When they are done they will rise out of the water and will not be spoiled.

NAMES AND ADDRESSES OF MANUFACTURERS WILL BE FURNISHED UPON REQUEST.

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Make Your Own Sun Lamp

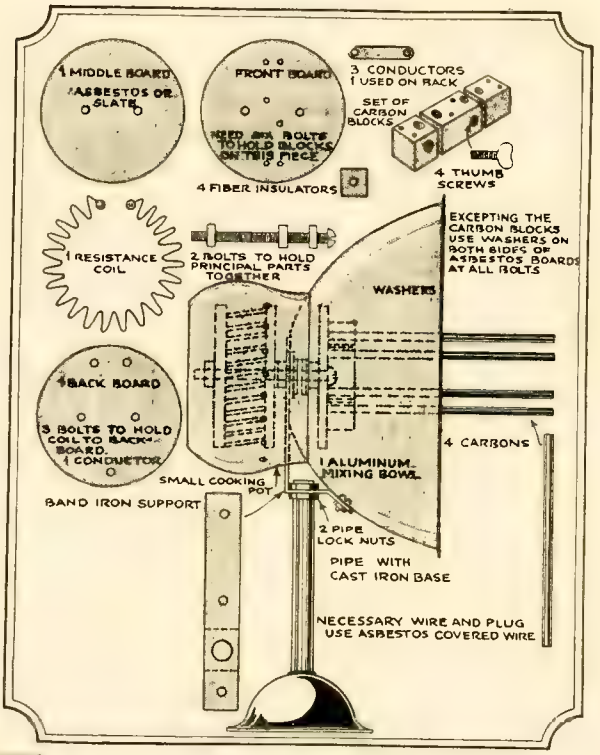
Here Is a Roman Candle Type Arc Lamp That You Can Construct Cheaply. For Motion Pictures or Stills, for Preparing Small Blueprints or Acquiring a Coat of Tan This Home-Made Product Can Be Used Satisfactorily.

By John Steinke

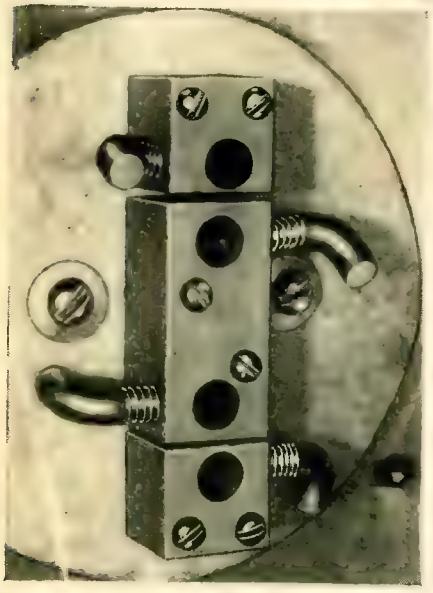
The lamp ready for use. Note the neat and attractive appearance which gives no hint of its home-made origin.

MANY arc lamps of various types have been placed on the market for sun tanning, as well as photographic work, some expensive, others, low priced. This lamp, however, can be made considerably cheaper than the least expensive and is as effective, besides presenting a finished appearance. It is efficient for taking motion pictures or still photography and for sun tanning. You can make small blueprints at night using this lamp.

Only a few simple operations are necessary to make the lamp as most parts are ready made. These are: hard asbestos board (or thin slate), a nine-inch aluminum mixing bowl, a one-quart saucepan, four thumb screws, resistance coil (can be taken from heater unit), asbestos covered wire, and a plug. A brass block ¾"×¾"×3⅛"; brass strips, band iron for a stand, fixture pipe, and an inside iron


1 MIDDLE BOARD ASBESTOS OR SLATE
FRONT BOARD
3 CONDUCTORS 1 USED ON BACK
SET OF CARBON BLOCKS
4 THUMB SCREWS
4 FIBER INSULATORS
1 RESISTANCE COIL
2 BOLTS TO HOLD PRINCIPAL PARTS TOGETHER
EXCEPTING THE CARBON BLOCKS USE WASHERS ON BOTH SIDES OF ASBESTOS BOARDS AT ALL BOLTS
WASHERS
1 BACK BOARD
3 BOLTS TO HOLD COIL TO BACK BOARD. 1 CONDUCTOR
4 CARBONS
1 ALUMINUM MIXING BOWL
SMALL COOKING POT
BAND IRON SUPPORT
2 PIPE LOCK NUTS
PIPE WITH CAST IRON BASE
NECESSARY WIRE AND PLUG USE ASBESTOS COVERED WIRE

Working plan of the assembled lamp; details of the resistance coil, a set of carbon blocks, and the front, middle, and back boards are also shown.



A close-up of the carbon holder unit. Note how the thumb screws are staggered. The round head bolt fitted with the washer is the three-inch bolt that holds the various units together.

base for a lamp. Bolts, fiber, and carbons. For tanning use Sunshine carbons. For photographic work, panchromatic carbons for panchromatic photographic material, or white flame for other subjects and blueprinting.

The most work is on the carbon holding unit. Cut the brass bar (brass is much preferred to iron which will do), into lengths of ¾ inch (two pieces), and one piece 1⅝ inches. Drill ⅛" holes for bolting to the base board, and 5/16" holes for the carbons. Note that the holes for the thumb screws are on opposite sides, permitting easy adjustment of the screws. Drill and tap the thumb screw holes for whatever small size thumb screw you may have handy. Next prepare the base boards, and get the boards ready for holding the resistance.

Three boards, each 4 inches in diameter are necessary, but with different arrangements of holes. Mark the board with a divider, lay out the holes, and cut. Asbestos can be sawed, or a series of holes drilled outside the circle, broken off, and filed smooth. Thin slate can be handled in the same way. Drill the bolt holes very accurately in all the pieces. Next cut three pieces of thin brass or copper ½"×2⅛", and punch or drill holes near the ends, spaced exactly 1⅝" center to center of the holes. Now in the bottom of the mixing bowl, cut or punch ½" holes with centers ⅞" from the center of the bowl. Now you are ready to assemble the parts.

Put the carbon holder blocks on with small 1¼" bolts. On diagonally opposite corners of the block layout, fasten two of the brass strips, so each goes to a bolt on a small block, and to the ¼" holes on the board. To save repeating; on all bolts, excepting where there is a brass strip, use washers on the asbestos side of the unit. Hold a thin business card between the brass units so as to bring them closely together, but yet not touching. Tighten the bolts firmly, but not too tight, for it may be necessary to shift the blocks to get proper adjustment. To hold the various units together, and in the bowl, use a 3/16"×3" round-head stove bolt which is threaded clear to the head. Slip the bolts through the ¼" hole on the carbon unit, making certain the bolts go through the brass strips. On the long bolts run a nut down the threads until the bolt is tightened on the board. This completes the carbon holder unit of the lamp.

Do this operation very carefully.

(*Continued on page* 849)

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For the Home Machinist

By George A. Luers

EVERY workshop has a workbench. Its height, position and construction are quite important to the quality of the work you do. And in this work, you may have occasion to tap for special sizes of screws, and prepare dies. You frequently use chisels; in order to fit up parts, scrapers are in constant demand; and files of various types are in constant use. This month, a full description of these tools and the workbench are given, with hints for their use and care.

While the fitting of very large parts must obviously be done on the shop floor, the smaller parts to be fitted, assembled, or hand tooled, should be handled on the bench. It should be rigid, placed at the correct height for working comfortably, and provided with ample light.

For supporting a heavy vise or pipe grip, the post bench is one of the best types. Here, as illustrated in Fig. 1, a post is used as a stand for the bench. Two pieces of oak or other hard wood, held by long bolts, are used to span this post. A hard wood top an inch and a half or more in thickness is added above these beams.

If a portable bench is built, the leg and top supports should be made as shown in the sketch. The triple fastening at each leg joint which assures long life with maximum rigidity is quite essential. Bolts or screws are preferable for securing parts of the bench. It is a good idea to avoid nails wherever possible, for the same hammer blows that drive in your nails will loosen them.

One of the jobs that you can do on your workbench is tapping for special sizes or making up odd sized screws to fit into tapped holes. As the usual dies and taps cannot be used, it is extremely helpful to know how these tools are made.

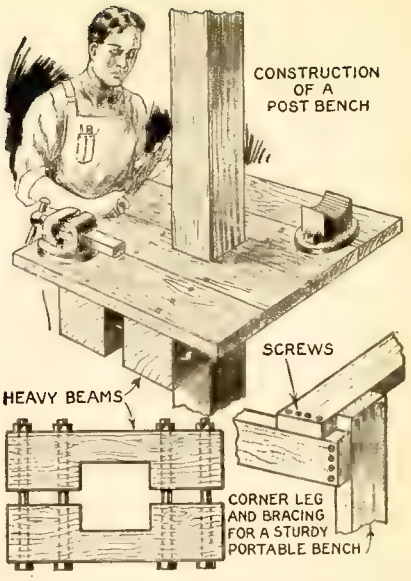

Fig. 1—A well-constructed, correctly placed workbench is quite necessary for satisfactory work.

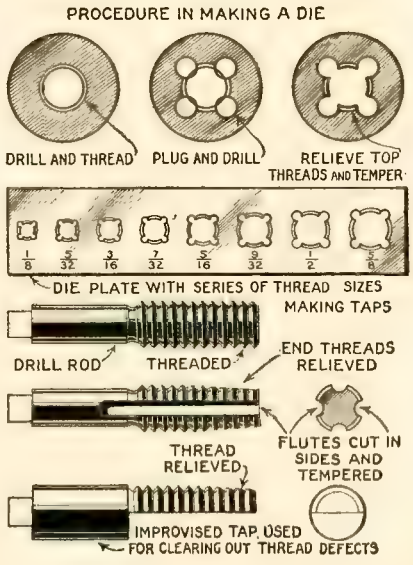
PROCEDURE IN MAKING A DIE
DRILL AND THREAD
PLUG AND DRILL
RELIEVE TOP THREADS AND TEMPER
1/8 5/32 3/16 7/32 5/16 9/32 1/2 5/8
DIE PLATE WITH SERIES OF THREAD SIZES
MAKING TAPS
DRILL ROD
THREADED
END THREADS RELIEVED
FLUTES CUT IN SIDES AND TEMPERED
THREAD RELIEVED
IMPROVISED TAP USED FOR CLEARING OUT THREAD DEFECTS

Fig. 2—As the usual taps and dies can not be used for special sizes of screws, these directions will help to make whatever additional ones you need.

The tap is made from drill rod, turned with the proper thread in the lathe. It is then fluted in the milling machine, the end is reduced to a tapering point and the starting threads are slightly backed off with the file. Tempering completes the tap. A special tap for clearing out old threads or undersized threads can be roughly and quickly made as per our illustration. The thread can be die cut, the metal can be cut away by grinding for half the diameter, and the tool, tempered. Of course you cannot expect a very neatly finished job with this hastily constructed tap.

Too often, the beginner or machine shop apprentice injures himself because the hammer misses completely or strikes the chisel he is using a glancing blow. Till practice enables the novice to handle a chisel safely he can slip a leather washer over the tool. It will serve as an excellent guard while he is

(*Continued on page* 839)

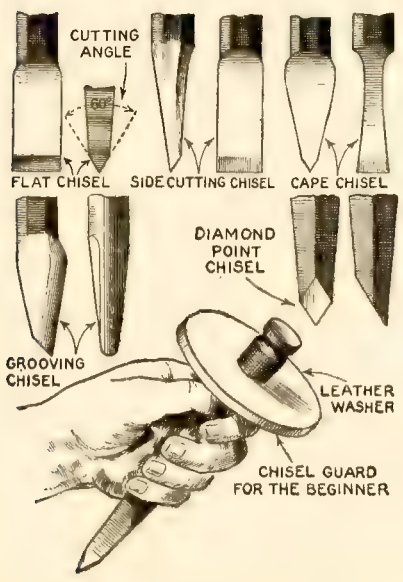

Fig. 3—The five general types of chisels. All should be adjusted to a 60° cutting angle for work.

Dies, as you will see from Fig. 2, are readily fashioned from tool steel plates, slightly thicker than the diameter of the part to be threaded. The plate is first drilled then placed in the lathe and the correct thread chased in the plate. The hole is plugged and clearance holes are drilled at the sides of the threaded area. Part of the die thread must be cut away to allow for clearance when starting to cut the thread. A tapered reamer is necessary for this work. The die is now ready for tempering. If a number of special sizes are required, a single plate of tool steel should be fitted with several sizes of threads.

This Page for the Home Machinist is a Monthly Feature of our magazine. . . . Its author is a Consulting Engineer by Profession, and is Supervisor of Ordnance Design at the Naval Gun Factory, Washington, D. C.

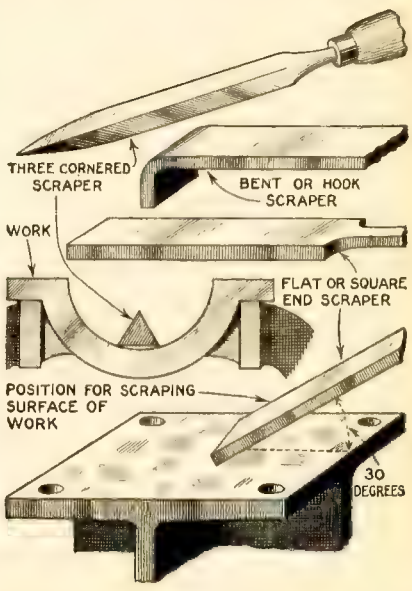

Fig. 4—After you have milled or shaped flat and curved surfaces, true them with a scraper.

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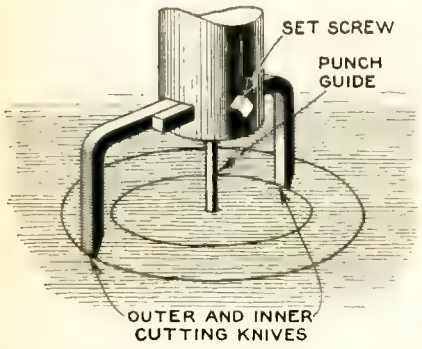
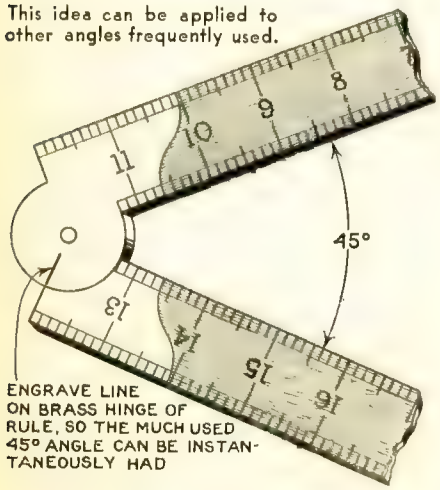
Try These in Your Own Workshop

The Best Among Our Home Enthusiasts' Monthly Hints



For Cutting Circles from Wood

HOLES from an inch to five inches and more, in diameter, can be cut from wood by using this simple device. It cuts out discs without pulverizing them, too. A punch guide, two cutting knives, set screws with which to fasten them, and a drill chuck are all the necessary equipment. Any blacksmith or iron worker will shape the sharp parts like auger knives for you, if you desire this work done by an expert.—*E. Moen.*


This idea can be applied to other angles frequently used.
45°
ENGRAVE LINE ON BRASS HINGE OF RULE, SO THE MUCH USED 45° ANGLE CAN BE INSTANTANEOUSLY HAD

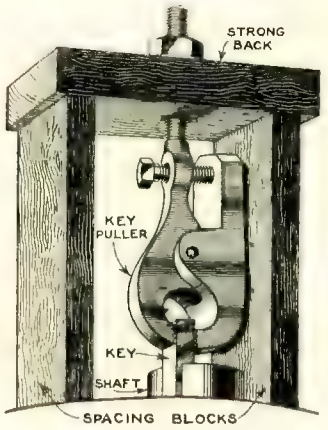
To Set Your Rule at 45 Degrees

THE 45-degree angle is the one used most often in planning work. Why not mark the measure on your folding rule so that you will be able to adjust it immediately at any time, to this angle? Using a known 45-degree angle, calibrate the rule by scribing a line on the brass hinge. It can be similarly marked for other angles.—*R. Wailes.*

Have you entered our model tool contest? Why not get your share of $3,250.00 in equipment for your home workshop. See page 813.

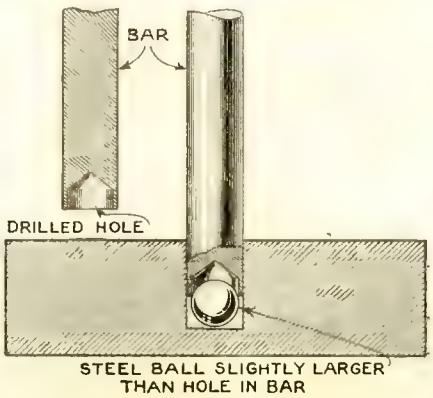
A Sturdy Key Puller

FOR pulling any type of key from couplings, flywheels and pulleys, you should have a powerful, rugged puller, and with hardened jaw and firm teeth to prevent slipping. The puller illustrated is easy to make and very efficient. —*H. Willey.*

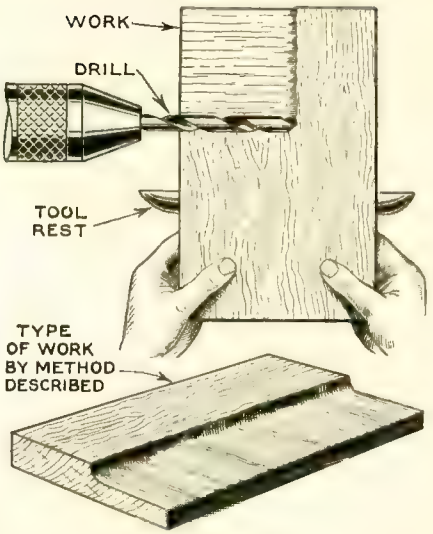


Fitting a Soft Iron Bar

THE next time you have occasion to fit a soft iron bar into a hole, proceed as follows: Drill a hole in the bar slightly smaller than its diameter. Then drop a ball bearing, which is larger than the diameter of this hole, into the hole into which you wish to insert the bar. As the soft iron is forced down into the hole, the hard ball bearing will spread it and hold the bar firmly in place.—*George May.*



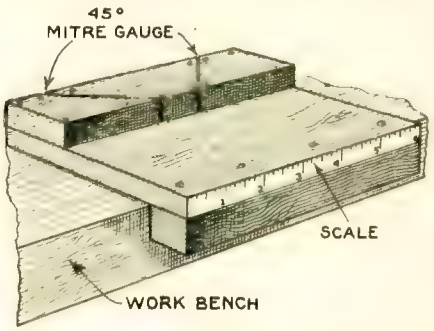
Using a Drill as a Planer or Gouge



PERHAPS you do not use a planer or gouge often, so have not purchased them. Or perhaps they break in the middle of an operation. You may not realize it, but your drill is a good substitute for these tools. Merely support the work upon the tool rest of a wood-turning lathe, and allow the portion to be shaped or gouged to come in contact with the point of the drill. While the work will not be as perfect as with the correct tool, it will serve the purpose.—*R. Wailes.*

Bench Hook and Mitre Gauge Combined

A BENCH hook, similar to the one illustrated, enables you to cut work to size with a stiff hack saw on the work



bench top. In addition, it can function as a mitre box. If it has no scale in front, paste or engrave one there. Then equip it with a left and a right 45-degree slot on the back cross member.—*R. Wailes.*

For Drilling Holes

VERY often one wishes to drill a hole in a pipe or other round stock, but due to the curved surface, the drill slips and by the time it does catch there are several marks on the pipe.

I find by cutting cross-lines (X) with a hack saw (not very deep), having the crossing right over the center of the hole to be drilled, I eliminate the hazard of slipping.—*E. A. Scheffler.*

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Prize Puzzles to Polish Your Wits

By Sam Loyd

THE Puzzle King presents the thirteenth of a series of problems, the solving of which will show if your mathematical ability is bolstered up by logical reasoning. Prize winners of the October puzzles and solutions will be found on page 863.

TWENTY-FIVE DOLLARS IN PRIZES

A FIRST PRIZE of $10 will be awarded to the person sending correct answers to the two puzzles, accompanied by the best expressed analysis of the Expectations Problem.

A SECOND PRIZE of $5 will be awarded for the next best analysis and correct answers to the two puzzles.

TEN PRIZES of $1 each will be awarded to the ten persons who send the next best analysis of the Expectations Problem together with correct answers to the two puzzles.

Answers must be received not later than noon, January 15, addressed to "Puzzle Editor," SCIENCE AND INVENTION, 331 Fourth Avenue, New York City.

All contestants must abide by the decisions of Sam Loyd, who will examine all papers and award the prizes.

Papers of identical merit, tying for any one of the prizes, will each receive the full amount of the prize tied for.

Dealing in Expectations or Exact Mathematics?

WHEN well-to-do John Robbins shuffled off this mortal coil, his blood relatives, whom he had snubbed impartially during his declining years, were left completely in the dark as to the old man's distribution of his possessions.

At a meeting of the natural heirs, before reading of the will, Robbins' two nephews and three nieces decided to do some dealing in their expectations. Their discussion led to the making of two separate bargains.

The nieces, Barbara, Celia and Dora, agreed to pool their prospective inheritances and each take one-third. Likewise, the nephews, Aaron and Edward, agreed to lump their portions and divide equally.

It transpired that all five had been generously remembered, although in somewhat varied degrees.

Peculiarly enough, the agreements entered into by the five heirs completely nullified the decedent's preferences, in that all five received like shares under the terms of their bargaining.

Incidentally, Uncle John left us a fair puzzle to remember him by.

To the information already set forth, let us supplement the following facts:

Had the provisions of the will been carried out, the combined shares of Aaron and Barbara would have amounted to $14,000. The shares of Barbara and Celia combined would have totaled $20,000. Celia and Dora together would have received $18,000, while Dora and Edward would have got $12,000.

There's enough data from which to reconstruct Uncle John's testamentary intentions. How much did he bequeath to Aaron, Barbara, Celia, Dora and Edward, respectively?

Rolling the Bones

AS the uninitiated soon learn when they venture to "roll the bones" with experienced "crap" shooters, the apparently simple game of chance is anything but a fair gamble. Leaving out of discussion the fellow who practices sleight-of-hand tricks and makes the cubes behave as he likes, there is yet the theory of chances involved in the game which makes it a "sure thing" for the adept when playing with the tyro.

The skilled player knows the exact mathematical chances for making the "crap" plays of 7 or 11, and is also posted on the exact odds for and against repeating the numbers thrown, (other than 2 or 12) which repeat constitutes a win.

These calculations are readily worked out by one versed in the elementary laws of chance, but the original game of craps, which came from India, is a more complicated problem, for the reason that three dice are thrown instead of two.

To consider only one feature of the old Hindu pastime, let us see who can figure out the chances for throwing three dice, in a single throw, so that they add up 7 or 11.

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The Oracle

Conducted by
Seymour A. Davidson

Meteorites

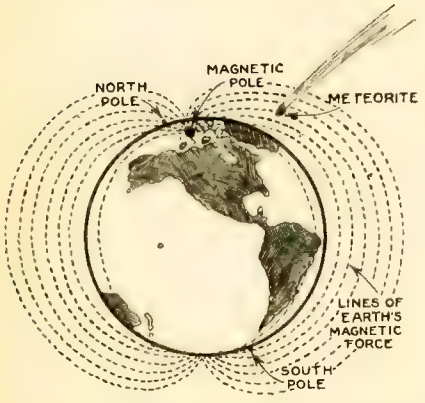
(2372) Mr. Andrew Perry, New Bedford, Mass., writes:

Question 1. Professor Luytins states in his article that the giant meteorite which fell near Grootfontein, in Southwest Africa, has its thicker portion resting in a hollow formed in a bed of limestone. It is my belief that the limestone, which is softer than the hard rock which supports the other side of the meteor, sagged because of the weight of the meteor, and the meteor being in a molten state at the moment of impact, flowed into the depression.

Question 2. Isn't it possible that the earth's magnetic north pole acted upon the meteor as it approached the earth and turned its mass in a north and south direction?

Answer 1. Granting the possibility that this meteorite was able to make a dent in the rock upon which it fell, we must bear in mind that although a meteorite attains great heat during its approach to our world, it does not reach the earth in a molten state, and therefore would not flow into a form which the force of its impact would dig.

Answer 2. A meteorite moves at a tremendous speed. Its momentum is



such that it is impossible for the relatively weak influence of the earth's magnetic force to deviate it from its course. Although a meteorite does not reach its melting point in its travel to the earth, the mass becomes red hot. A red-hot body cannot be magnetized and therefore any magnetic field through which the meteorite passes would not affect it. It is questionable if it had polarity.

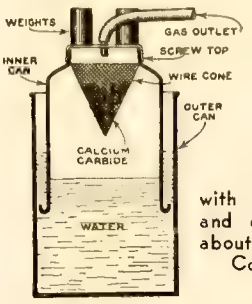
An Acetylene Generator

(2373) Mr. John D. Walker, South Bend, Ind., writes:

Question 1. I would like to build an acetylene generator. The one I want to make must be simple, cheap and capable of being handled with safety. Can you furnish me with plans or a description which would enable me to assemble the unit which I require.

Answer 1. A very satisfactory generator can be made from two cans.

The covers of both cans are removed and one of them is filled with water. The other can, which must be of such a diameter that it is able to slide easily in and out of the first can, is fitted with a plug bottom which can be unscrewed. A fine mesh screen cone is attached by its base to the bottom of the can so that it can be filled with carbide when the plug is taken out.



The handy worker can make this efficient automatic acetylene generator by fitting two discarded milk cans with some of the odds and ends usually found about the workshop. Cost is negligible.

The two cans are now fitted together. The weight of the floating can forces it down until the carbide filled cone makes contact with the water. Acetylene gas is immediately generated and imparts buoyancy to the can, which rises so that the cone no longer touches the water, resulting in a cessation of the production of gas.

As gas is drawn from the generator, the cone again touches the water and the above described process repeats itself.

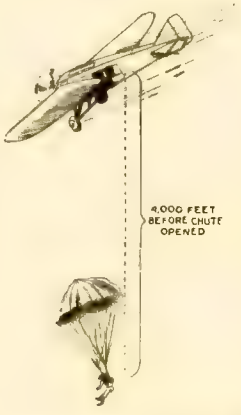
Should the acetylene be produced too quickly or in too large quantities, the excess gas will bubble out through the water between the two cans.

Can We Survive a Hard Fall?

(2374) Mr. Matthew Burns, Trenton, N. J., writes:

Question 1. My friend and I had an argument about how a man would be affected in a fall from a great height. I claim that the man would live until he struck the ground. My friend claims that inability to breathe while traveling at such a high rate of speed would cause the man to suffocate. Who was right?

Answer 1. Until recently the popular theory was that difficulty in breathing incurred in a long fall would kill a man before he made contact with the ground. However, daring aviators have disproved this theory by dropping far through space before opening their parachutes. We cite as an example the case of Harold Whitby, who traveled 4,000 feet before allowing his parachute to control his descent.



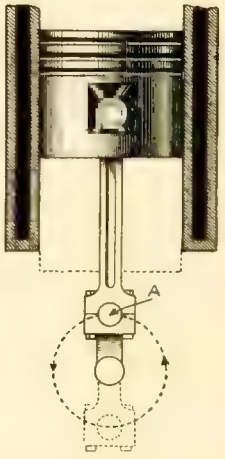
4000 feet is a long way for a man to fall freely. However, the men who made jumps of this nature have reported that they were in complete possession of their faculties during the speedy descent.

The Oracle is devoted to questions of general interest to our readers. Direct mail answers will be given at the rate of fifty cents per question.

Does the Piston Stop?

(2375) Mr. Clarence E. Walberg, Worcester, Mass., writes:

Question 1. I have been very much puzzled by the piston action in a motor-car engine. People whom I have queried have given me conflicting answers. Some say that the piston comes to a dead stop at the top of each stroke in changing direction. Others claim that the piston not only comes to a dead stop in reversing its direction, but that it also goes through a deceleration period in coming to a stop from the high speed at which it is traveling up the cylinder wall. Assuming that there is absolutely no play in the crankshaft or piston bearings, these being theoretically perfect, what actually happens?



Section of a typical cylinder is shown. The dotted lines indicate the position which the piston assumes at the bottom of its stroke.

Answer 1. As stated in your question, we shall assume in this discussion that the piston and crankshaft bearings are theoretically perfect, permitting absolutely no play.

The piston attains its greatest height or lowest depth in the cylinder when its position is such that the connecting rod is a continuation of a diameter of the circle, which is described by the movement of the crankshaft. We shall consider the first case.

This condition prevails only when the crankshaft is at point "A." A point by geometric definition possesses neither length, breadth nor thickness; it is merely a location. As the crankshaft is always in motion, every point on the circumference of the circle through which it passes is either approaching "A" or receding from "A" by definition.

(*Continued on page* 849)

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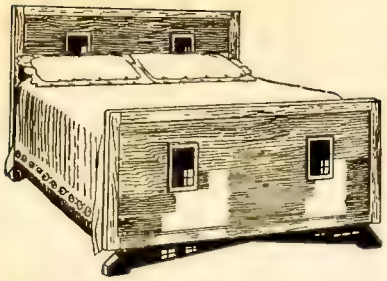

Fig. 1—The finished bedstead in oak, 4 ft. 6 ins. wide.

Making a Compact Oak Bedroom Suite

Part II

Bedstead and Tallboy Cabinet

By J. E. Lovett

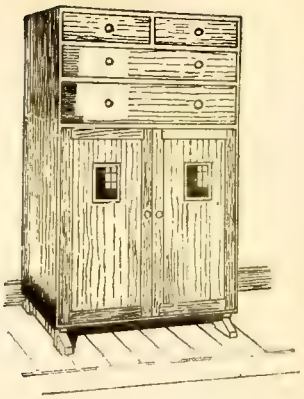

Fig. 6—The finished tallboy cabinet in oak, 4 ft. high by 2 ft. 6 ins. wide.

THE BEDSTEAD

TO match the dressing table described last month, the bedstead illustrated here is allotted a width of 4 ft. 6 ins., the head and foot being 48 ins. and 28 ins. high, respectively. For a 3 ft. bedstead deduct 18 ins. in length from items C, D, E, F, G, H and I, and keep one set of facings to each panel.

As a guide to finish, the base (D) is intended for ebonizing, also the top panel facings; the rest of the bedstead might be of blue oak.

The head posts (A) and rails (C, E and F), together with the foot posts (B) and rails (C) should be of selected, straight-grained oak for first choice. Fig. 2 gives all the necessary sizes for shouldering the rails, and Fig. 4 shows three mortises on the inside edges of each of the head posts for the corresponding tenons of the head-rails. Between the two tenons on the bottom of the head posts and also on the edges of the rails, grooves to a depth of ⅜ in. must be worked for the bottom head panel (G)—this panel, of course, being clamped up with the rails.

The panels (H and I) Fig. 2, may be of oak-faced plywood, and are simply pinned and glued to their respective frames. If, however, a thicker panel is desired, a suitable section is given in Fig. 5. This entails much more labor, but is recommended because of its strength.

To some readers, the space behind the oak plywood panel on the foot end may appear unsightly. To remedy this, a suitable wood moulding might be introduced; (or better still) an oak plywood panel might be used on both sides of the foot end frame. If the latter idea is adopted, a vertical rail, placed centrally between the foot posts and tenoned into the top and bottom rails, would be advisable.

As the base (D) is intended for ebonizing, it might be of close-grained birch, shaped as in Fig. 1 and stained and finally fixed by screwing up into the bottom rail (C).

The foot and head panels have as their decoration four sets of raised facings, grouped up to either side of the centre. All facings are allowed ⅛ in. of thickness. Those (J), next the panel, should be in white sycamore, while the top facings are in ebony or in birch ebonized. Glue to the panels and stop any pinholes. When polishing, use only white shellac on the facings, as they are intended to be finished in their natural color.

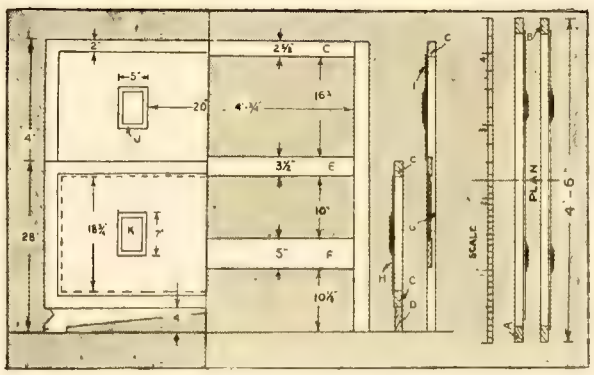

Fig. 2—Scale elevations and sections of head and foot ends of bedstead. Plan given at right.

Wooden sides with 10-in. French castors would be a decided improvement, inasmuch as the bedstead may easily be swung out for sweeping the floor. If iron sides are to be used, iron corner bracket French castors may be used. One-inch domes of silence or brass bowl castors are good and cheap alternatives. Do not leave the corner posts without castors or the domes.

THE TALLBOY CABINET

For modern use the bedroom tallboy, Fig. 6, stands about 4 ft. high. The drawers at the top are accommodating, while the enclosed cupboard below is intended for the week-end suit-case and a trousers press, or (alternately) for millinery purposes, boots and shoes, etc.

CARCASE

The items required for the carcase are the ends (P), top (H), bottom (J), drawer rails (K), and division clamp (O). Fig. 8 gives a general survey of the constructional preparation for the separate pieces. The ends and top should be of quartered straight-grained oak, but plain oak will suffice for the bottom board. Select good, mild stuff for the drawer rails. Fig. 9 shows the development and finish of the mitre dove-tail, which is the intended joint for top and ends. This is rather a tricky joint to cut and will require caution, both in marking and making to bring both dovetails up to a neat and effective mitre. As alternative joints, the double lap dovetail or tongue and groove would make an efficient substitute.

The ends (P) are clamped on the front edges to allow the drawer sides to stand clear. Work tongues on front edges of ends and groove the end clamps correspondingly.

In Fig. 8 are seen the rebates on the bottom edges of the ends for the carcase bottom. Rebates across the ends for the cupboard top (Q) must be worked 3/16 in. deep and to a width of 9/16 in. Groove the carcase top across the grain to a depth of ⅛ in. and width of ¾ in. for the drawer division (N), and in line with

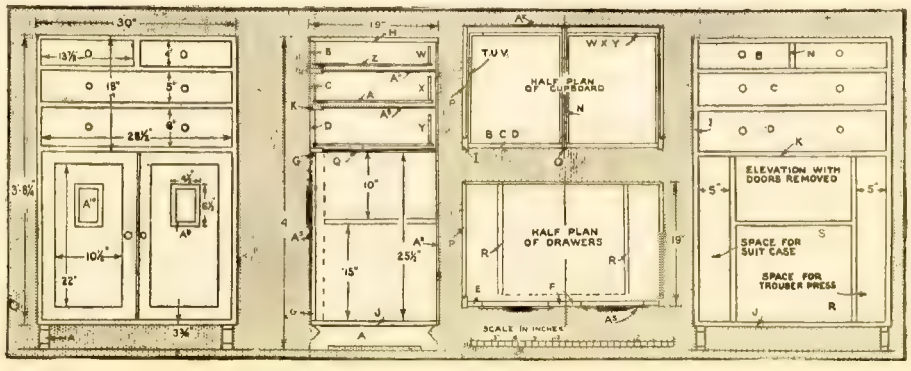

Fig. 7—Elevations of tallboy cabinet with doors closed (left) and open (right), sections and plans in centre.

(*Continued on p.* 858)

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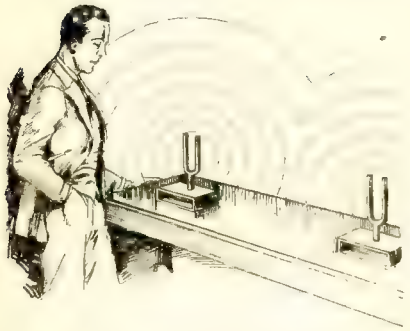
Scientific Problems and Puzzles

By Ernest K. Chapin

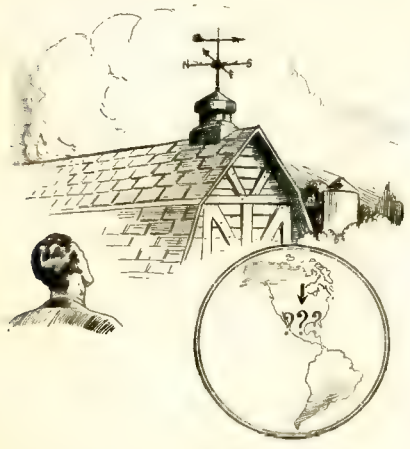
Resonance in Tuning Forks



MOUNT two similar tuning forks on suitable resonance boxes and place them a few feet apart. If one of the tuning forks is set vibrating for a moment and then stopped it will be noticed that the other fork is vibrating. Does the second fork receive its energy principally from the sound waves that strike the prongs of the fork or from the waves which enter the resonance box?

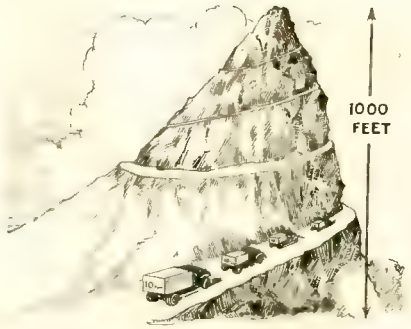
Where Will the Air Go?

THE movements of air currents have engaged the attention of numerous scientists. Their studies have brought to light many heretofore unknown and interesting facts. In accordance with definite laws and the knowledge which modern science has given us, in what direction can we safely say air will blow if pushed south?



What a Gallon of Gasoline Will Do

GASOLINE distributors are extolling the virtues of their products in nation-wide advertising campaigns. The thought has often been expressed that it is not the individual fuel, but the efficiency of the consuming motor which counts the most in deriving the greatest amount of work from gasoline. To illustrate our point: If automobiles were 100 per cent. efficient, would a gallon of gasoline yield energy sufficient to lift four ten-ton trucks to the top of a mountain a thousand feet high?



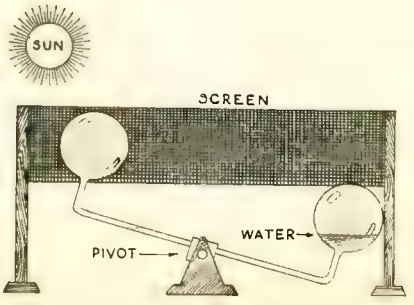
Effect of Static Electricity on Water

CHARGE a rubber comb with static electricity by rubbing with a piece of wool or silk cloth and bring it near a dripping flow of water. The water drops will immediately coalesce

to form a continuous jet. When the comb is removed the jet will again break up into separate and individual drops. Are you able to explain this phenomenon?

The Radiation Teeter-Toter

A SIMPLE teeter-toter is set up as indicated in our diagram. Bearing in mind that the bulb which occupies the higher position will always be shielded from the sun's rays, can you explain the operation which enables this device to maintain motion as long as the sun shines upon it?



Water-Pipe Elocution

DISCONCERTING and startling is the loud hammering sound which is so frequently heard when one turns off a water faucet. Have you noticed whether this disturbing reaction is apt to be more violent in the case of a hot water faucet than in that of a cold water tap? Can you adequately substantiate your answer?

How Heavy Is Air?

WE commonly think of the atmosphere about us as having no weight. However, if the air which is present in an ordinary five-room bungalow were liquefied, do you believe you would be able to lift the vessel in which it was contained?

The Thrust of a Ladder Against the Ground

IF a ladder leans against a smooth wall, do you think that the thrust of the ladder against the ground is equal to or more than the combined weight of the ladder and the load which it is carrying?

Answers to These Problems Will Be Found on Page 852

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The band saw nearly completed.

Build This Band Saw of Laminated Wood

By H. O. Harris

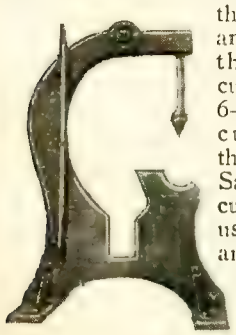
The finished band saw, with driving motor in position. Note the lamp to illuminate the table.

THOSE serious-minded individuals whose hobby takes them to the home workshop, will get a real thrill from constructing this useful and practical machine tool. The construction is fairly simple but must be accurate. The results are astounding and will save many calories.

The frame, in fact the entire machine, with the exception of bearings, shaft, tilting device and thrusts, is constructed of five ply fir, three-quarters of an inch thick. This material can be purchased at some lumber yards or cabinet works. One slab three by seven feet will be sufficient with plenty left over.

It is best to lay out the frame design on a piece of building paper according to the drawing, Fig. 1. Lay off three rectangles on the slab and mark the lines A, B, C, D, on opposite sides of the two outside pieces. Be sure they are correct, for you will need them later. Lay on the template, whose corresponding lines coincide with those on the slab. Mark the two outside pieces with the grain running up and down, while the middle piece is marked with the grain running crosswise.

Just a word about cutting, that is if you do it yourself. You may nail the three pieces together and have it cut; it will save some work but it is fun to do it yourself. The writer cut each piece separately on a jig saw. You can do it too. With the hand saw cut the lines 1-2, 3-4, and D-5; then with the jig cut the curve of the back, 6-7, and cut the curve running through 2 and 4. Save the material cut out as it is used for the wheels and table top. Doing the cutting in this manner will save considerable weight and the lumber is much easier and simpler to handle.



Compare this view with the diagram, Fig. 1.

The two outside pieces are cut alike, while the inside will eventually have a slightly different measurement at two points. However, this need not prevent you from cutting all three pieces at once. After cutting, put all three pieces together, even up as much as possible and bolt firmly together, using quarter inch carriage bolts two and a half inches long, with washers. Clamp in the vice and with a spoke shave and plane even it up all the way around. You now have three pieces of five ply lumber, aggregating two and a quarter inches thick, and very strong. Now take apart, clamp the two outside pieces together and cut the adjustment slot in the base, using a fine hand saw. Cut the arc on the front as true as possible on the jig saw. Cut the slot, which is one inch narrower, on the middle piece.

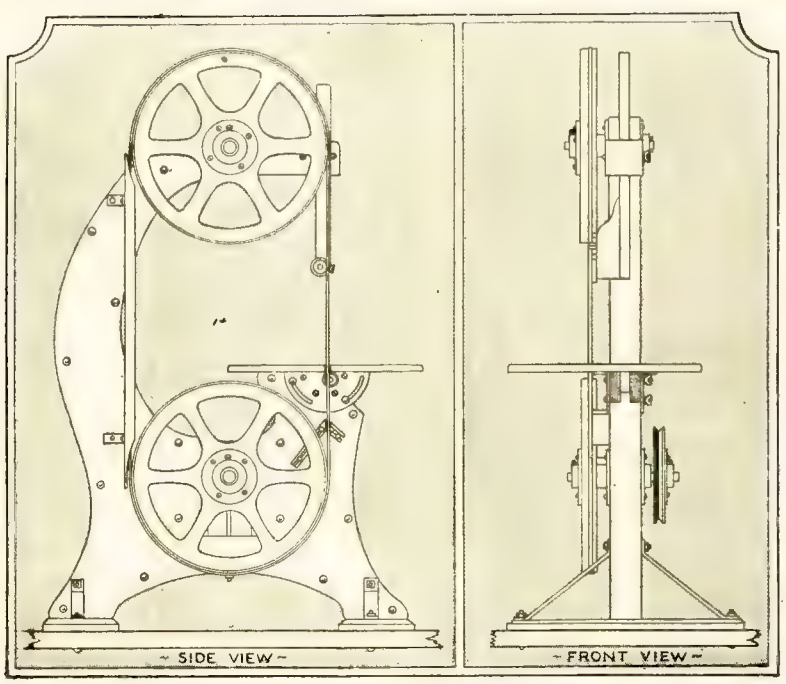


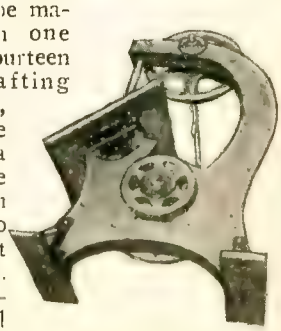
Fig. 3:—Side and front elevations of the completed saw, showing how the various parts are fitted together.

Turn a disk out of three-quarter inch ply wood whose radius is equal to that of the arc in the outside pieces, and cover the edge with sandpaper. The method of securing the ends of the sandpaper strips to the disk with slots and wedges is shown in the drawing Fig. 4. Sand out the two arcs to the correct dimensions, being careful to hold the work parallel to the revolving disk. You now have a perfect arc.

Cut three pieces of the ply wood, that will just fit across the slots, snugly but not tightly; they are of the length of the flange-diameter, which is three and a half inches. Clamp these together and bore a seven-eighths inch hole exactly in the center and also bore the same size hole in the top of the frame, to come vertically above the center of the slots, taking care to get both straight. These holes are for the bearings, upper and lower.

For the base, two pieces of ply wood five inches wide and fourteen inches long are cut, beveled all the way around, and screwed to the under side of the feet. Four angle or corner irons are bolted to the frame. The base is drilled and the whole bolted to a strong rigid bench.

Purchase four half-inch floor flanges and two half-inch brass nipples three and a half inches long. Have the threads on the nipples run down so they will screw into the flange side of the floor flange all the way through to a tight fit at the other end the threads should be run down a good quarter of an inch further to a loose fit. This is important. Take the floor flange with the nipple screwed tight to your machine and have the nipple bored for a five-eighths inch shaft. Square off the flange and bore the outer rim. This can all be machined with one chucking. Fourteen inches of shafting will be plenty, and this can be cut with a hacksaw to the correct length as the two shafts are not of equal length.



View showing underside of saw table.

The top bearing is slipped into (*Cont'd on page* 840)

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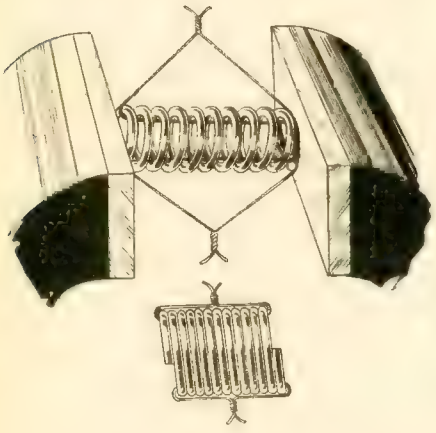
Wrinkles and Recipes

To Replace Strong Coil Springs

BY inserting two pieces of wire in the spring as shown and compressing in a vise, after which the wires are drawn tight and the ends of each twisted together, strong coil springs may be easily replaced.

Then cutting the wires which compress the spring with a pair of wire cutters after the spring is in place, will complete the job.—*Joseph D. Ambrose.*

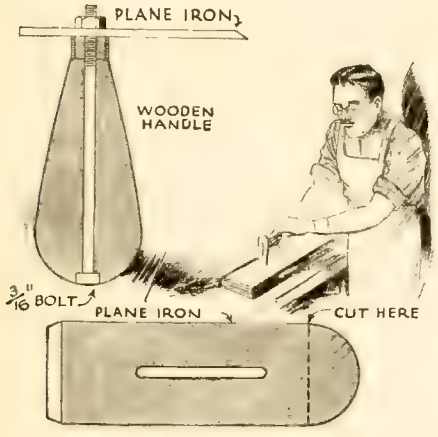


Smelling Salts

IN a small watch crystal mix 15 c. c. of ammonium carbonate and a few drops of oil of lavender. Put this mixture in a small vial and keep it corked except when it is used.—*Benjamin Heller.*

Wood Scraper

ANY man who works with wood may have an old block plane iron which he can use as an ideal scraper. Merely



take the blade and cut the top portion off straight (or you can leave it as it is). Then get an old handle, drill or burn a hole through it at least large enough to hold a 3/16" bolt. Put the blade on, the bolt through the handle, and tighten the nut.—*F. M. Edwards.*

First Prize, $5.00

Two-Way Entrance

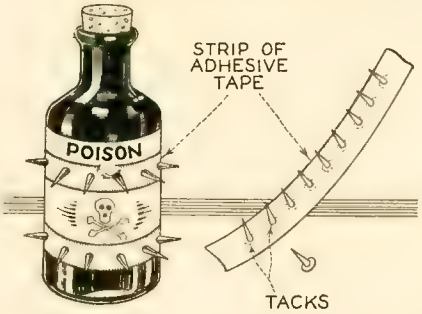
YOU can lock sliding doors on the inside and outside with padlocks and enter from either side with the device illustrated, which is made of strap iron. It will also apply to doors that slide against a post or wall.—*Dr. J. J. Edwards.*

Water for the Laboratory

AN electric soldering iron will be found useful in heating small quantities of water, but the point must be on watertight to protect the heating element.—*Robert Huish.*

To Prevent Being Poisoned

PERHAPS the following hint will prevent the accidental taking of poisons. Push several very small tacks



through adhesive tape so that the points project from the dry side. The strips should then be placed around boxes or bottles containing poison. Anyone picking them up hurriedly will immediately realize, when he is pricked, that he is handling poison.—*Jack Ridenour.*

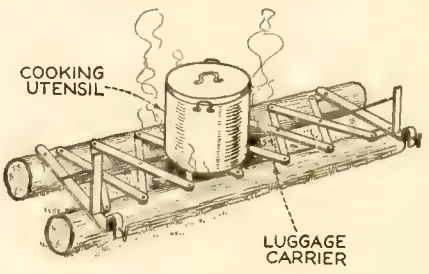
$5.00 is paid each month for the best Wrinkle or Recipe accepted and published in these columns. All others used are paid for at regular rates. Address: Editor, Wrinkles and Recipes.

Air for the Blowpipe

DENTISTS and mechanics often find it convenient to have air for their blowpipes, but do not have a small compressor for the amount of work. In this case a vacuum cleaner can be obtained from a second hand store for a dollar or so which will serve the purpose. A connection can readily be made to be put in the place of the dust bag attachment. This can be connected with the blowpipe by means of a piece of rubber tubing. It will also be convenient to have a switch at the motor and a resistance coil in the circuit could be used to control the amount of air.—*Edward L. J. Prudhomme.*

Open Fire Grate for Camping

AN improvised open fire grate can be made by detaching the luggage "gate" from the running board of the

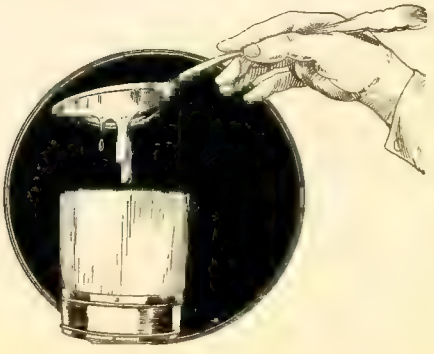


automobile and placing it over two logs in the manner illustrated. A fire is kindled between these logs and an impromptu hot breakfast can be had on a chilly morning, with the aid of a frying pan and coffee pot. The motor tourist who has no room in his car for a camp stove will find this particularly helpful.

—*Lieutenant Buckley Barrett.*

If Your Paint Brush Sheds

VARNISH will hold the bristles in a paint brush that has a tendency to shed. With the bristles turned upward, pour a spoonful or two of clear varnish upon them. Keep the brush in this vertical position until the varnish drys, usually a day or two.—*Mrs. H. E. Chrisman.*



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What's New in Radio

Self-Tuning Device

A NEW and outstanding novelty is a new 24-hour self-tuning device recently introduced by Lyric Radio. In the centre of this device is a watch, and around it are arranged 96 little levers which pull vertically out in ten graduated movements. Each lever corresponds to one fifteen-minute period of the day. Also mounted in the centre of the device is a tablet graduated in nine divisions, each one of which can be lettered by the user to correspond to his nine favorite stations. If, for example, WJZ is No. 7 on the tablet, and it is desired to hear that station's program between 6.15 and 7 p.m., the levers marked 6.15, 6.30, and 6.45 o'clock are pulled out to the graduation marked 7, but the set is not switched on. There is no need to worry further, or keep an eye on the clock. Promptly at 6.15 the radio set will be automatically switched on, and will remain on, tuned to WJZ, till seven o'clock. During the course of the program, further levers may be set for any of the other stations, at any other times, and as soon as one desired program terminates, the set will be automatically tuned to the next station. If it is desired to switch off the set at any predetermined time, the lever corresponding to that time is pulled out to the No. 10 graduation, and at the termination of the program at that time the set will be automatically switched off.

A Battery That Breathes

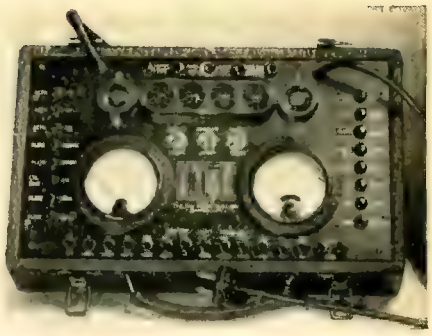
A NEW "breathing battery" which literally takes oxygen from the air as its source of long life and constantly sustained voltage has recently been placed on the market. The essential life-giving oxygen is drawn into the battery directly from the air instead of being supplied by oxygen bearing chemicals and minerals built in to the battery, as heretofore. With an unlimited supply of oxygen available, this new battery is said to have remarkably long life and, in contrast with other forms of batteries, maintains a practically constant voltage throughout its life without recharging. A special carbon electrode functions as the lungs of the battery, from which it gets its name "air cell." It will run a 7-tube receiver, using the new 2-volt tubes, for a year, if the set is used three hours a day.

Jenkins Television Programs

Test radiovision programs are being transmitted nightly except Saturday and Sundays, from 8 to 10 P. M., Eastern Standard Time, by Station W2XCD of the DeForest Radio Company at Passaic, N. J. The signals, transmitted on 2065 Kc., are of the standard 48-line, 15 pictures per second category. The power is sufficient to cover New York areas.

A Portable Test Oscillator

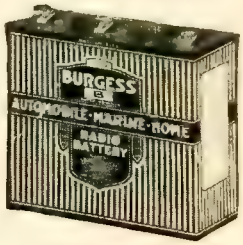
THIS instrument should appeal particularly not only to the laboratory worker but also to the retail radio dealer and service man. In a readily portable form, this instrument combines a variable frequency R.F. oscillator with a range of 1,500 to 550 Kc., with fixed frequency oscillators of 175 and 180 Kc., with a vernier for the variations required for aligning the I.F. stages of superheterodynes. It is equipped with an output meter for visually indicating resonance. It operates on 110 volts A.C. 60 or 25 cycles, or 110 volts D.C., or external batteries for filament supply, and on one small "B" battery for plate supply. A compartment is provided for the "B" battery. The signal intensity may be varied over wide limits, and the instrument is completely shielded and mounted in a durable carrying case, complete with special leads and full instructions as to its operation.



Combination Set Analyzer and Tube Checker

ALSO of interest to the dealer and service man is the new Flewelling combination analyzer and tube checker. This instrument combines in a single leather carrying case a complete set analyzer and A.C. tube checker. It will make a complete analysis of all circuit conditions existing in any radio receiver or electrical apparatus within the limits of 800 volts A.C. or D.C., and current up to 100 milliamperes. The instrument is manufactured for use on 60 cycle 110-115 volt A.C. circuits and can also be furnished for use on 25 cycle 110-115 volt and 60 cycle 220 volt A.C. circuits. A complete tube checker is included, together with a reference chart of tube ratings, engraved on the panel as an integral part of the instrument, thus permitting not only a complete analysis of the circuit of any receiver, but also an independent check on all its tubes. The instrument is operated by means of push buttons, and eleven meter ranges are available through the use of pin jacks for external testing. The whole instrument is fully protected by circuit arrangement so that no damage can result from incorrect operation, accidental or otherwise.

Instruments such as these serve a very great number of purposes and enable the trouble shooter to find out in the shortest possible space of time exactly what is wrong with a radio set, and where.



Automobile Radio Battery

WITH the ever-increasing popularity of radio on automobiles these days, it is perhaps not surprising that battery manufacturers are turning their attention to the production of special batteries for such use. The type illustrated here was used by the Byrd Antartic Expedition. It is of the same construction as all Burgess batteries, with seamless zinc cans, paraffined containers, shock-proof and waterproof.

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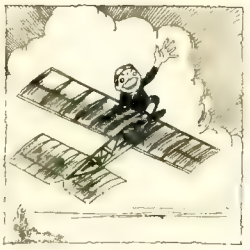
The SAFETY

This Department Is Conducted by and for You. Expressions of Opinion or

A Glider from Science and Invention Plans

I AM enclosing two views of a glider manufactured during past vacation season from specifications given in your August number, 1929, by George A. Gerber. It was built at an expense of $15.85, and we find the same very satisfactory, due to enlarging the wing spread to 14 feet, instead of 12 feet as shown on sketch.



I am a member of the local High School Glider Club, and have built a larger model than this one with the help of the other members.

We thought you might be interested in knowing and seeing a view of the glider manufactured by myself without any help during the past vacation season, and wishing you further success with your magazine, which I read from cover to cover, I am

HERMAN G. DEURER, JR.,
Lebanon, Pa.

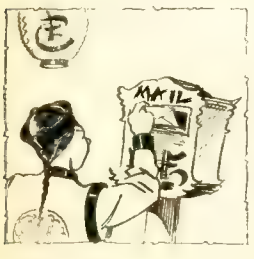
(*We certainly are glad to hear from you and appreciate the photographs which you so kindly forwarded.*—EDITOR.)

One of the views of the glider Herman G. Deurer, Jr., built from our plans.

Even China Has Puzzle Fans

I DON'T know whether these solutions to your contest will come to you within the time limit.

I find that I can solve practically every one of your puzzles, but there is not sufficient time for my letter to reach your office, and I therefore have to give up every chance to engage in these contests.



I don't think that you would care to exclude the right of entering contests to any of your readers who live outside of America. Is it not possible that the interim be prolonged?

I am a Chinese high school boy and a subscriber to your magazine. I received your publication this morning and mailed this letter in the afternoon, after spending but a few hours in solving the puzzles.

S. K. KAO,
Shanghai, China.

(*Your letter arrived just one day late. An air-mail stamp would have carried it to its destination on time. We will try to arrange our future contests so that even those in far-off lands will have ample time to solve the problems and send in their replies. We thought that we had done so in this case.*—EDITOR.)

Now a Brickbat for the Family Doctor

PAGE 347 of SCIENCE AND INVENTION, middle of column on the middle page, in an article entitled "A Bouquet for the Family Doctor" was read by me. After that I read the reply of the Editor. (This is in the August, 1930, issue.)

I don't think medicine has done any good to mankind. Not only do I think it that way, but I am sure of it. Chemistry, natural and unnatural, furnishes the authoritative claim.

Your reply was, as I have seen, based on statistical figures, which, as any sensible man can clearly see, mean nothing at all. Factors or figures are only figures and no more, and statistics are an unreliable authority. Before statistics could be a true guide, the cause of things and results of things, condition, environment, education, training and all that should be taken into consideration, and not only base your statistical figures as due to the introduction of the poisonous, filthy serums administered to the patients at a certain period. It is true that the people you mean may have been innoculated or poisoned, but their injections could not alone be considered as the foundation or main cause of the decrease of death, since the regular practice of injecting serums had been put into use sensibly or insensibly by medical devil quacks, that only could live by trying to make conditions worse.

Give me examples of the serumized people who possess the best health and clearest brains. None! I can give you thousands of examples of the non-serumized class who possess the healthiest babies and clearest brains and are the best citizens on earth you can find. To satisfy you let me give you one, just only one, Mr. Bernard Shaw. He even defied inheritance. What is he now? You know it. Write to him and you will be convinced. Then after all you will give up claims for better conditions based on statistics, bunk all the time. Permit me for being so rough. But nature is rough. The truth is rough when once its course is violated. But its roughness is of the true kind. So no need for apology.

The truth about people going wrong, especially those under the sway of medical quacks, is that business, in order to gain money for food, is behind all their purposes, instead of sincerity and true service for the greatest good of all. Do away with doctors, They are all quacks. They got over their quackiness only after resorting to natural means of prevention.

Of course, iodine and mercurochrome are needed for minor cuts but they can be made, not by doctors. Doctor quacks will soon die.

N. PASCUAL,
Seattle, Wash.

(*When two communities, practically adjacent, having substantially the same weather conditions, being peopled by the same class, and living under substantially the same environment, have different smallpox death rates, and when a smaller death rate is found in those areas where vaccines are compulsory, the inference is obvious. When one town reduces its death rate while vaccinations are enforced, then suddenly decides to dispense with them and finds that the death rate again increases for the same disease and upon restoring the compulsory treatment, discovers that the death rate is again decreased, the inference is also obvious.*

The mere fact that one man or a dozen has lived to a ripe old age without employing some of the modern methods of maintaining health, is not an indication that the people of the entire country, under similar conditions and environment, would also live to a ripe old age without having dispensed with the various means and methods that modern medicine has discovered. We know of some savages who have lived to a ripe old age. Nevertheless, the death rate among them is considerably higher than that in civilized communities where the population may be more dense and where accidental death is more frequent.—EDITOR.)

Pooh-Pooh

GLANCING through your current issue, I note on page 388 some illustrations and a brief note concerning the new Hudson Bridge, now in course of construction. The note states that the great span will be 3,500 feet long and "the greatest suspension bridge in the world." Splendid! But will it hold that honor long?

We of this coast and San Francisco, and the San Francisco Bay region think it will not. As witness the projected Golden Gate Bridge, whose plans — now finally approved — call for a span 4,200 feet long, or 700 feet longer than the impressive span of the Hudson Bridge.

I enclose a clipping from the *San Francisco Chronicle* giving some data on the Golden Gate Bridge. I feel sure that

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VALVE

Conducted by
THE EDITOR

Comments Are Welcome. Please Address Them to Editor, Science and Invention

Science and Invention, as well as its readers, will be interested in the figures there given, and in the fact that a favorable vote on the bond issue for building the bridge, to be held in the near future, is the only remaining obstacle to such building. The Bridge District which the directors designated has been created by law, the favorable report by engineers upon the borings for piers has been given; plans were finally approved by the War Department; and also by Bridge District Directors. There is strong public interest in the project, the need for which is great.

We on this coast sometimes feel that the East Coast does not always keep informed upon our doings even when they are of general interest. So, though only a layman in engineering matters, I take the liberty of writing the above, and to say that there seems good reason to believe that the bond issue referred to will be authorized and the work will proceed.

May I add that the San Francisco Bay District has another big bridge project: viz., the Bay Bridge, to span San Francisco Bay from San Francisco to Oakland. It will be quite a different type of bridge—cantilever I believe—much longer, with a number of spans, the longest two of which are to be 1700 feet each. As the entire bridge will be several miles long, and will join the East Bay region to San Francisco, the project is perhaps even a larger one than the Golden Gate Bridge. Taken together these two projects should give the San Francisco Bay metropolitan area a conspicuous place in the engineering world; and they will minister to the needs of one of the world's greatest seaports; one with a bright future, as strategically the center and focus of this coast's growing trade on that ocean that is becoming the bearer of an ever larger and larger share of the world's commerce.

Harlan Bailey,
San Francisco, Cal.

(*Back issues of* Science and Invention *magazine have contained articles on the projected Golden Gate Bridge and also on the San Francisco Bay Bridge, from San Francisco to Oakland.*

The editors of this publication try to keep in touch with things that go on throughout the world. It is natural that a project as momentous as either of these two would not pass unnoticed.—Editor.)

We'll Be Swell-Headed Soon

JUST a few words of praise for the Science and Invention magazine. It is a wonderful makeup of news; a thoroughly enjoyable and interesting current of inventions, and a wholesome and magnetic book for the minds of both young and old. I am spellbound when reading the different articles about science, the most wonderful thing in the world of culture and education. It certainly shows that the editor knows what he is putting in this magazine. I just happened to pick up a copy of this magazine at a leisure moment, and, after reading that issue, I have a hard time waiting for the postman to bring each month's issue. Here's wishing it many, many years of success.

Mary L. Fanning,
Chicago, Ill.

(*We too hope that you will continue to enjoy* Science and Invention magazine *for many years to come.*—Editor.)

Air Stations on the Tops of Skyscrapers

AS a constant reader and interested in the progress of your magazine, I thought that you might be interested in an idea which I think is the most practical way to solve the Airport Problem in large cities.

It seems to me foolishness to build a large skyscraper only to adorn the air with its slimness and beauty, when it could also act as a huge column to support an overhead airdrome. There is no doubt that more buildings such as the Empire State Building are in the future anticipation. Then why not locate them and design them to support huge trusses which, in turn, would support a large airdrome. Not only would such an idea assist air travel, but would encourage it, because many fear to dive from 1000 feet altitudes to the ground. With the airport higher than natural building obstructions, what need would there be to dive to earth to land?

The cost of such a project would be immense, but like the Holland Tunnel I think it would rapidly pay for itself.

Felix A. Wallace,
Brooklyn, N. Y.

(*Practically every architect foresees the possibility of erecting huge landing platforms on the top of some of our buildings. As a matter of fact, the "Empire State Building" in New York City will have a dirigible mooring mast at the top. It is not likely that future aircraft will require a long run-way. It is very possible that sufficient landing space will be found in an area not greater than* 50 *feet square for the commercial aircraft of tomorrow. We, therefore, do not agree with our architects. While a landing platform on the top of an isolated building may be good practice, the top of the structure need not be built entirely flat to take care of the planes even* 25 *years hence. Nevertheless, such a project has been considerable interest to the editors of* Science and Invention *and the readers of this publication have seen similar plans time and again.*—Editor.)

America's Gliding Boat

BEING a constant reader of your magazine Science and Invention, I saw a small article in the October number, Vol. XVIII, No. 6, on page 512 regarding a new glider boat, as used in Germany, and would like to draw your attention to the fact that this is strictly an American invention, designed and tested in Brooklyn, 1921-1926, by Col. Marcel de Passy for whom I used to work as a mechanic. He was formerly a German naval and aeronautical architect and Zeppelin pilot and constructor and is years ahead in naval and aeronautical craft, and has spent a fortune in experimenting and testing his designs. With financial backing he will come out next Summer, and I am sure, will surprise many, so-called "speed kings." Some of his 30 by 60 ft. waterbusses, have made 102-129 M.P.H. in secret tests in Gravesend Bay; and his Rigid Airships, models of which have been built are at least 20 years ahead of so-called "new improvements" in the Zeppelins built at Lakehurst, Akron or in Germany. His ships can never break. He also worked out air propeller-driven railroad trains for tremendous speeds, and as everything is perfected now, he will be ready by Spring to show his different craft in operation. He is well known in Washington, and among naval and aeronautical men.

Chas. Johnson,
Brooklyn, N. Y.

Why Baldness?

THE Safety Valve of October, 1930, Science and Invention contains an inquiry about growing hair. The answer refers to May, 1929, issue, in which a longer treatment of the subject appeared.

In neither of these items was there any reference to a circumstance which gives the best explanation. Hand it over with your next answer to a question. It follows:

Physical development of man, as relates to hair growth, is now undergoing a change. In past geological times hair covered the entire body. Now hair grows less abundantly, and what has grown, often falls out, leaving baldness in its place. That means that the human body is changing so that hair will not grow on it in future days. The present time is a time of change in the physical construction of man.

From the practical standpoint of hair

(*Continued on page* 859)

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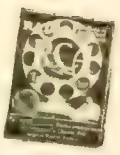

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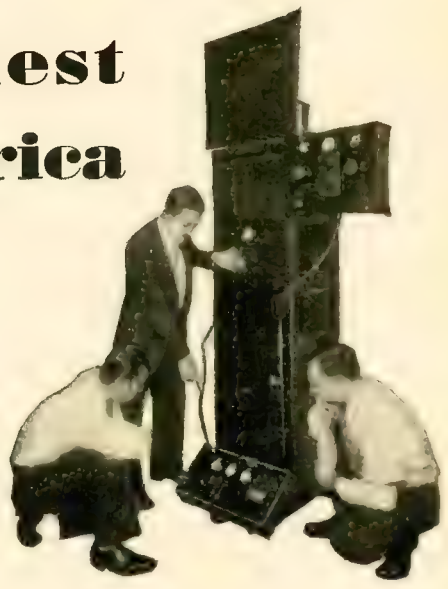

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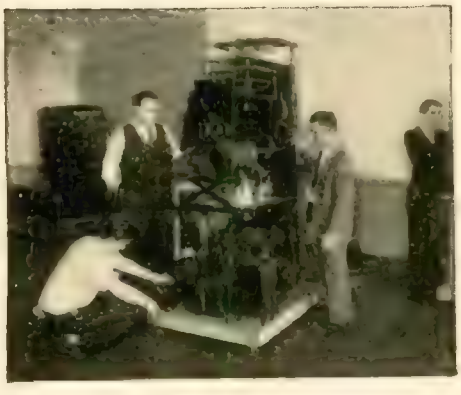

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CONDUCTED BY JOSEPH H. KRAUS

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Should advice be desired by mail, a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

Ice Cream Freezer

(1246) H. M. Pitman, of Dallas, Texas, is very enthusiastic about a system for producing ice cream, which he intends to use with regular Frigidaire equipment. He sees no reason why he cannot get others to see the advantages and possibilities.

A. Ice cream stores have found many years ago that it pays to handle a better grade of cream. In New York, Hydrox, Breyer's, Reid's, Horton's, and Anheuser-Bush are the outstanding "popular" ice creams. These manufacturers have spent countless sums of money in advertising. They are constantly developing new styles and new combinations, which the average man could not possibly develop.

There are a great many small ice-cream stores (not including the chain stores), that manufacture their own products, and they have special cream freezers for that purpose. Unfortunately, the quality is usually not there, and the same holds true for the ice-cream stores in your immediate neighborhood and in other parts of the United States. A bootlegger can make gin, rye or scotch, yet these products do not possess the quality of the pre-Volsteadian liquors.

It is conceivable that if your device were placed on the market, it might meet with a small sale. You could not possibly get a basic patent on the situation, and hence, any other manufacturer desirous of placing a similar device on the market, could considerably lessen any cash returns that you might be able to develop.

Incidentally, motor-driven ice-cream freezers could be developed along Frigidaire lines, which would not necessitate a constant beating. For household refrigerators, your device is decidedly impractical, for a hole would have to be drilled in the top of the refrigerator to accommodate your ice-cream freezer. One can make ice cream in the ordinary Frigidaire without requiring the beating operation. We do not wonder that others have not looked upon this idea with any degree of enthusiasm. Our own suggestion would be to forget about it.

Automatic Automobile Brakes

(1247) Mr. Stanley Hearn, Camden, N. J., has designed an automobile bumper which applies the brakes the instant that the automobile strikes an object. He asks our opinion.

A. We do not believe that any automobile bumper that is so arranged that it can apply the brakes at the moment the bumper strikes an object, is worthy of consideration. The time to apply brakes to the wheels of an automobile is before the bumper strikes an object and not at the instant of the impact. The momentum of any car is sufficient to cause it to drive forward for a considerable distance even if the brakes are jammed on. It is doubtful if the force of the impact would be reduced in the least. We would not suggest further procedure.

Airplane Speed Indicator

(1248) Walter J. Gazdzik, Philadelphia, Pa., asks whether or not a simple system has been developed which will accurately give the aviator information as to the rate of speed his ship in traveling in land miles. He suggests a method of producing an instrument depending upon the ratio between air speed and engine speed to record land miles on a dial.

A. By subtracting the air speed in miles of an airplane from the wind velocity the aviator can only approximately determine his land speed. If he can make observations, then he can plot his speed with a fair degree of exactitude. However, there is no system known today which will give the airplane pilot a true reading of land speed. Such a reading must be arrived at by calculation.

We believe that a patent on a device recording on a dial the land mile speed of a plane would be lucrative to the inventor.

It is quite impossible to have an arrangement by which the air speed and the engine speed may be measured to give the ratio in land miles. The engine speed has very little to do with the speed of a plane. Variations in propeller pitch, variations in air density, variation or changes in wing structure due to snow, sleet and the like, and the necessity for attaining altitude all affect the land mile speed of a plane.

Suppose an airplane is flying against a cross wind of 30 miles an hour, a plane of slippage on the part of the plane. Because the plane is not flying directly into the wind or against it, his land mile speed would be nothing like any form of ratio between the two factors. With a cross wind of 30 miles an hour, a plane capable of traveling 50 miles an hour would only cover 40. Flying directly across the wind, a plane capable of going but 40 miles would cover 50 land miles in an hour.

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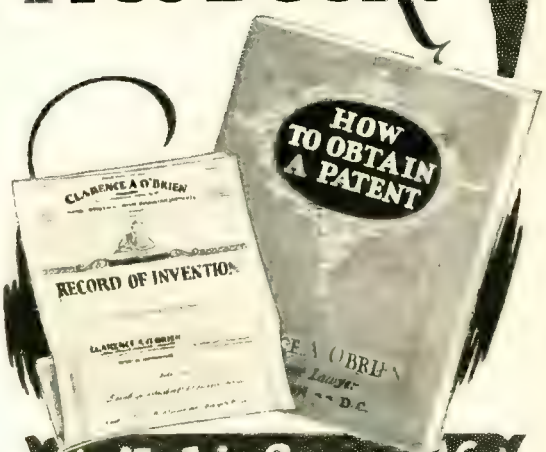

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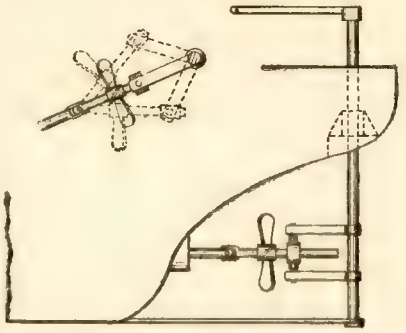
A Rudderless Ship

No. 1,744,848, Issued to J. D. Russell

THIS invention provides a means of using the screw, not only as the



propeller of a ship, but also as a dependable, efficient and easily controlled steering device which completely eliminates the rudder. The propeller is not mounted directly upon the propeller shaft. A universal joint is provided at the end of the main shaft. The other end of the universal joint is fitted to the auxiliary shaft to which the propeller is secured.

A rudder post is provided back of the propeller to which two stays are rigidly bolted. These are jointed to a sleeve which is mounted upon the shaft back of the propeller, which shaft extending back of the propeller is partly supported by this bearing or sleeve, so that it may slide longitudinally therein.

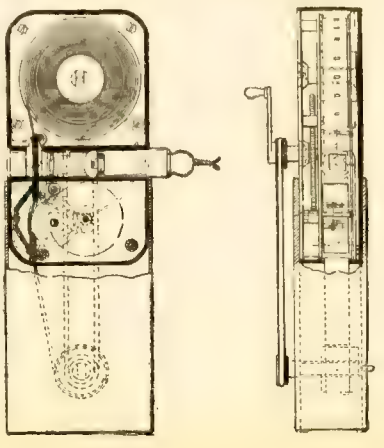
Moving of the tiller turns the propeller to the right or left and so gives the desired steering effect.

A Pocket Projector

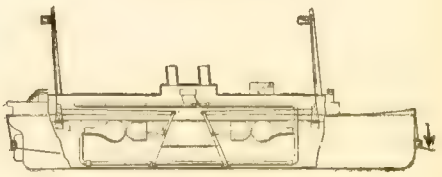
No. 1,774,097, Issued to P. Hauser

A CINEMATOGRAPH, whose outside dimensions are 2" × 4" × 1", is the subject of this patent. The apparatus is so constructed that it may be used in the dark as is the usual type of projector or in daylight when the moving pictures can be viewed by individual observers only.

If it is desired to project the moving film upon a screen, an electric lamp of the flashlight type is incorporated in the device. For daylight use a simple microscope can be inserted in front of the lens. The microscope should be fitted with a large eyepiece, which will rest on the border of the eye socket, comfortably to the user.



Remote Control

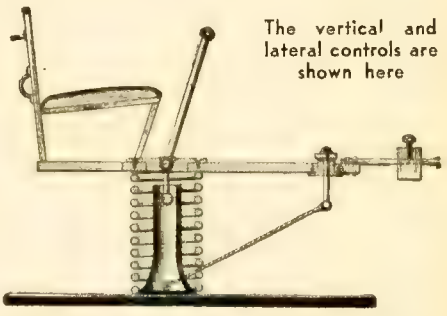


No. 1,773,973, issued to R. Edgar

THE invention provides a means of operating a model ship from the shore by cords, which run from the boat to the manipulator, who is on land. By a system of pulleys, levers and compressible air bulbs within the hull the operator handling the cords can cause the ship to describe a given course, blow whistles, and raise or lower flags and sails from a distance.

Mechanical Flying Instructor

No. 1,773,936, Issued to A. J. Bertram



The vertical and lateral controls are shown here

THIS relates to a device which is expected to be of great help to those studying flying at home. The pupil's seat is so placed that manipulation of a lever located at the right side and of a foot bar, corresponding to the "joy" stick and rudder bar of an aeroplane respectively, produce movements of the seat which simulate the positions which the pilot's body would assume in actual flight. Practice with this apparatus should insure to the user proper coordination of certain muscles necessary for perfect flight and develop a sense of equilibrium without the pupil ever entering the plane.

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How Hot Are the Stars?

(*Continued from page 782*)

the star's heat. The instrument is attached to a telescope, which is trained upon the star to be examined. The star-rays fall upon a concave mirror and are focused upon a thermocouple juncture.

The deflection of the galvanometer when a star is focused on the thermocouple is a measure of the heat received from the star. With this instrument it has been found that stellar temperatures range from 23,000° centigrade absolute (41,400° F.) for the very blue stars like *Zeta* Orionis, to 6,000° C. absolute (10,800° F.) for those like the sun, and 1,800° C. absolute (3,240° F.) for the very red long-period variable stars like *Omicron* Ceti.

The coolest stars observed are very red and give little visual light in proportion to their heat.

The Moon Is Hot!

The hottest stars do not necessarily give us the most heat. They radiate the most heat per unit of area, but a cooler star may be so much larger that its total radiation exceeds that of the hotter star. There are stars like the electric light—small, very hot and bright, with comparatively little heat outside the visual region; and there are stars like a stove—big, comparatively cool, and faint visually, but with an enormous amount of heat radiation, radiation which can be measured.

If the temperature of a star is known and the total amount of energy radiated from it can be obtained, its diameter may be calculated. If the distance to the star is known, the total radiation from it can be obtained from that falling on the mirror of the telescope.

The study of temperatures on the planets has revealed many strange facts. Mercury is certainly very hot and has little, if no atmosphere. The maximum temperature is about 800° F. Venus is covered with clouds and the radiation measured is from the high cloud surfaces and tells very little except by inference about the actual surface temperatures. The temperature on Mars varies greatly with the season and the time of day, but it is somewhat like that on the earth.

The temperature of the moon has been a subject of investigation for seven years. The temperature at the point on the moon where the sun is directly overhead has been found to be 244° F. at the time of full moon and 149° F. at first and third quarters. Measurements made on the dark side of the moon gave —243° for its approximate temperature. During the lunar eclipse of June 14, 1927, the temperature fell from 156° to —179° F. during totality, or a fall of 335° F. During a solar eclipse on the earth there is a fall of about five degrees. This shows the effect of atmosphere. The moon has no atmosphere; the earth has.

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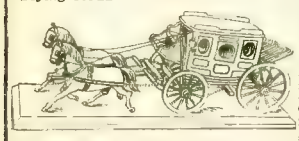

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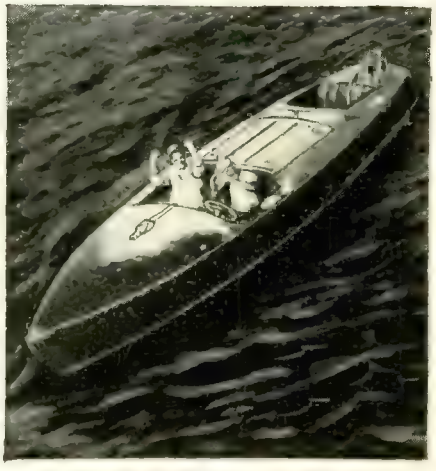
We buoyed a course of approximately four hundred yards square on Flushing Bay and then, armed with three bombs consisting of paper bags, each containing a pound of flour, our glider was launched at an altitude of about three hundred feet. Driving the car from which the glider had been launched, I shot forward onto the course while the glider tried to tag me. Bill Zilcer was at the controls and Dick Pope, well known aquaplane rider did the bomb throwing. The tagging process may be seen in the accompanying illustration.

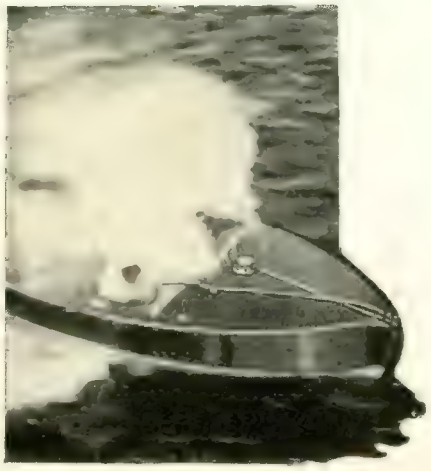
According to the rules of the game which we evolved, the boat must stay within the buoyed course while the bomb is being thrown. The boat may dodge, swerve, and double; but it must not leave the course.

After a few games of glider-tag it was demonstrated that the best way to plant a bomb was for the glider to sneak up behind the boat like an airplane riding the tail of another. In this position, which may be assumed by a glider pilot who has a few hours to his credit, an average of one direct hit in three at an altitude of about a hundred feet is attained.

The advantages of the game are three. In the first place it provides a source of competition between the glider and the boat or automobile that launches it. Secondly it provides problems in dexterity to the glider pilot. And last of all it makes for precision in dropping a bomb on a moving mark . . . a possible war time use.

Looking up at the glider, Jackie Kerr and Doc Schnurmacher express their feelings at Dick Pope's direct hit.





With plenty of splash, the flour bomb from the plane landed on the boat.

In this regard, we have launched a glider at an altitude of a thousand feet. With a gliding angle of twenty to one, it has flown well over three miles. The glider costs considerably less than a thousand dollars, and would provide an inexpensive and accurate means of exploding bombs on an enemy fleet or army from a nearby base. Being noiseless, it has a distinct advantage over the airplane for night work.

Right now, however, we're concerned with peacetime pursuits, and that means glider-tag. It is a good idea not to use flour for bombing purposes but to use a cheap talcum powder, or powdered chalk if you're going to tag over the water. It explodes just as satisfactorily and you won't have to put in the hours I did cleaning up the boat and myself after the flour and spray had made a fine paste.

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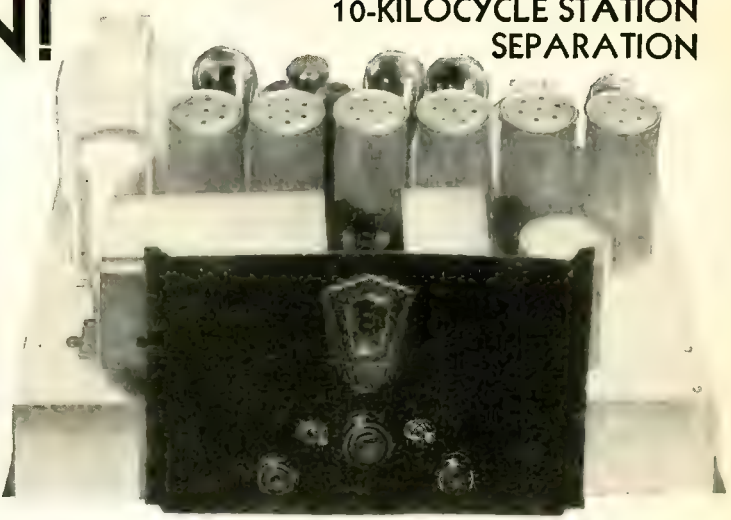

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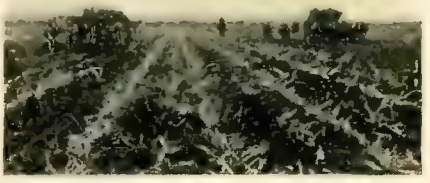
How Science Saved Our Sugar

(*Continued from page 789*)

Agriculture had broadcast a warning that the mosaic disease (known in Porto Rico as the mottling disease and in Java and Hawaii as the yellow-stripe disease) threatened the sugar industry of the southern States.

The effect of the disease is to stunt the plant's growth, and this means smaller yields per acre. The virus of this wasting plant malady is carried by an insect, the corn aphid, and is also spread by man in moving diseased seed cane to uninfected areas in planting. It is impossible to treat the cane or the soil to cure a plant affected by mosaic disease or prevent the spread of the trouble. The measures that scientists therefore had to take for its control and eradication were based on the destruction of the diseased plants, including the stubble, and the planting of healthy stalks only.

The search for resistant varieties of cane took government men to many foreign countries. But more about that later while we see how the first disease-resistant plant came into being.



Several rows of cane are planted in a furrow to compensate for damage through disease and borers.

The original Louisiana sugar canes were characterized by their relatively high sugar content. On the slopes of the Himalayas flourished canes which, by a process of the survival of the fittest, have become able to resist disease and to withstand considerable cold. Dr. Jan Kobus, in an experimental station in East Java maintained by the Dutch, crossed that slim Himalayan cane containing a nearly negligible amount of sugar with the high sugar-bearing cane of Louisiana, and obtained a cane that would resist the mosaic disease, and which was rich in sugar and more rugged than that formerly planted in Louisiana.

Thus came into being hybrids which are now known as the *POJ* varieties, and which are now helping to fill Louisiana's "sugar bowl."

The canes imported from Java were planted under glass on the governmental experimental farm at Arlington, Va., and there propagated for observation by Dr. Brandes and his associates. The variety designated as *POJ* 234 was tried out in the spring of 1922 on the Southdown Plantation in Louisiana. But investigators and research workers do not always—in fact, seldom—find things easy. And this work was no exception. Of the whole shipment of cane only twenty-one eyes succeeded in germinating, and then the cane borer got busy trying to destroy those! Enough survived, however, to show that the work was progressing in the right direction.

In 1923 the Department of Agriculture sent two more of Dr. Kobus' hybrids, *POJ* 36 and *POJ* 213, to the Southdown Plantation for a continuation of the experimental work, and by the end of 1924 there had been planted here four acres of *POJ* 234 variety and a short row each of *POJ* 36 and *POJ* 213. All three canes proved to be highly resistant to the mosaic disease, and they gave excellent yields while growing under the same conditions as neighboring canes of the old varieties, which were by that time almost completely incapable of producing stalks fit for seed purposes. Sugar cane is germinated from pieces of the fully developed cane, and about fifteen per cent of the crop is employed for this purpose.

New Life to Dying Crops

The majority of the sugar planters in Louisiana were decidedly skeptical of the claims made for the new canes, which were tested out even further during the season of 1925. And then came the disastrous sugar cane crop of 1926, which proved to the planters that an urgent need existed for a change. Government agricultural scientists, with the co-operation of the Southdown Plantation and the American Sugar Cane League were able by this time to place the *POJ* varieties at the disposal of planters. In 1927, about one-fourth of the total acreage was planted in mosaic-resisting sugar cane, which resulted in the average yield for the crop harvested being raised to 13.4 tons per acre, as against 6.7 tons in the preceding year. In 1928 more than three-fourths of the cane planted was disease resisting, and the yields were amazing. From *POJ* 213 one planter obtained an average of 37 tons of cane per acre; and from *POJ* 36, another realized as much as 46 tons per acre!

The years 1929 and 1930 saw even further progress being made.

The U. S. Department of Agriculture is still searching, however, for hybrids that may prove to be even superior to the famous *POJ* varieties. In April, 1928, accompanied by Dr. Jakob Jesweit of Holland, and by a member of the Hawaiian Sugar Planters' Association, Dr. Brandes visited New Guinea, which is credited with being the original home of the sugar cane. There a search was made for wild varieties of sugar cane, and by penetrating 260 miles into the interior of that country a total of more than 150 new strains was obtained and brought back to Washington. After undergoing a full year's quarantine, in order to be sure that no disease would be introduced, these new varieties are now being experimented with in the various government laboratories and experimental farms.

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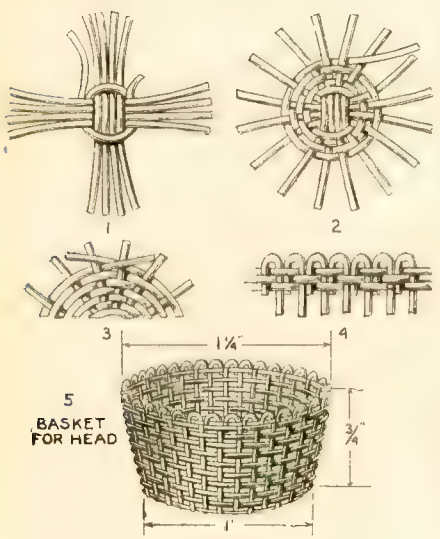
A Model Guillotine

(*Continued from page* 808)

serve as a weight for the knife. For the rope a piece of twisted twine about 15" long should be cut and boiled in coffee to stain it the appropriate color. Some dark oak stain will be required to stain the woodwork.

For the knife itself, dig up an old or broken plane iron to be ground down to the correct size. The sharpest possible edge should be put on the knife to enable it to cut through cigar ends easily. To be historically accurate, the ground or inclined side of the knife edge should be toward the body of the victim, but as the victim in this case will be the cigar, it is better to so grind the knife that the inclined or ground edge is outward, towards the end of the cigar. This will permit the end of the cigar to be trimmed with a clean cut. At the expense of still further technical accuracy, an old safety razor blade can be utilized as the knife, and the size of the lead weight increased accordingly.



How to fashion the guillotine basket.

Please note in making the pulley block for the rope, drill the central hole first through a suitably sized piece of box wood, then trim to the size and shape of the block afterwards. In assembling the parts, drill small holes for the securing brads; otherwise you may split the wood and have the trouble of remaking parts.

The square headed wood screws, T, are made flat and square with a file by filing down the round heads of ordinary wood screws. Before filing them, drive in the screw and back it out two or three times until the screw goes in easily Then remove the screw and file the head to the desired shape and replace with a pair of pliers. The screws are filed square to make them resemble the hand forged spikes which were used at that time.

Rafia is used to make the basket which catches the head of the victim—in this case the guillotined end of the cigar. If you follow the diagrams closely you should not have any difficulty in this connection. Soften the rafia until it is pliable and dampen it from time to time.

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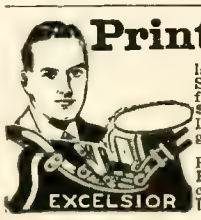

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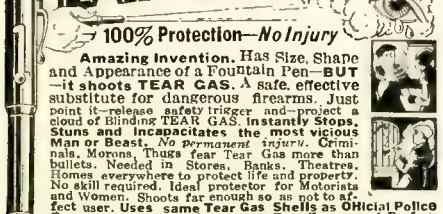

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"There She Blows!"

(*Continued from page 781*)

In addition to all this, the baleen whale produces the whalebone that was once used extensively in ladies corset stays, buggy whips and umbrellas; steel ribs replaced whalebone as stiffening in the latter article, and the thin steel stay took the place of the pliable little piece of whalebone that went into the torturing corset.

Whalebone is not part of the skeleton of a whale, as many think. It is a series of 300 or 400 horny plates, which grow from the palate of a baleen whale and hang down into the mouth. The plates are somewhat triangular in shape, the bases are rooted in the palate. Both apex and inner edge are frayed into horny shreds. The plates grow from parallel ridges on the palate, which are covered with long fibers (vascular papillae) like cocoanut fiber. It is fused together at the base to form the plates and is horny at the surface. The whale, when he is in quest of food, opens his cavernous jaws and cruises through the feeding grounds. Tons of water, laden with shrimp, tiny salmon and other small sea life, enter the capacious maw; the mouth is closed, the tongue raised and the water forced out; the whalebone acts as a strainer or sieve and retains the food. The whale has to swallow the food supply at his leisure on account of his small throat opening and the fact that he has no teeth with which to masticate.

In the manufacture of useful articles from whalebone, the plate is first cut in parallel prism-shaped strips, which are then dried and levelled by planing.

The shavings are sometimes used as stuffing for mattresses. When heated by steam, whalebone softens, and can be bent or moulded into shapes which it will retain if allowed to cool under pressure. The essential constituent of whalebone appears to be albumen, its hardness being probably increased by the small proportion of phosphate of lime.

The Precious Ambergris and Its Uses

A Bowhead whale 50 to 55 feet in length has been known to produce 3500 pounds of black whalebone.

As one can see from the above list, the whale is a pretty diversified producer of trade articles, but there is still one product that he presents to mankind that is the most valuable of all, and so far as research goes, the whale is the only living thing that produces this extremely rare article, known to commerce as Ambergris. Although 20,000 to 30,000 whales are being slaughtered yearly, very few of the mammals produce Ambergris, which comes from the sperm whale only. This great whale, with one-third of its body devoted to head, feeds on cuttle fish squid, octopus and other fish, some of which live on the sea bottom; it may have from forty to fifty-two teeth in its lower jaw, but as a rule there are no teeth in the upper jaw, but sometimes there are six or eight pair of malformed ones.

Anyway, it is due to the sperm's teeth that mankind is indebted for the precious ambergris which has a value four times greater than gold, and for which spirited bidding is the rule when this sticky substance is put up for sale in the trade marts of the world. Its present value is between $75 and $85 an ounce.

The Sperm whale, having teeth, eats crustaceans, and like man in many cases, he fails to properly chew his food. As a result the bones and villainous poisons that infest the victims of his food supply, affect Mr. Whale's digestive apparatus and in time he develops a bad case of stomach trouble—in man it would be called Choletith or gall stones; in whale it is called Cholestreol or ambergris. Ambergris is nothing more or less than vomit from the interior of a sick whale.

Constantly Filling Mankind's Pocketbook

When first disgorged by the mammal, it is of the consistency of wax. It is white, ash gray, yellow or black and often variegated, like a boy's pet agate marble; for a few days it floats a fathom or so under the surface of the sea, then the action of the water and air causes it to come to the top; the floating masses are sometimes from 60 to 200 pounds in weight and it has only a slight and not disagreeable odor. Nevertheless it is a great delicacy for the sea birds and every whale hunter is constantly on the out-look for a flock of gulls that seem to be battling over some drifting object—it might be ambergris.

Ambergris is used for the most delicate and expensive perfumes, not as an odor itself, but as a fixing agent to retain permanently the other odors. A very slight quantity of ambergris added to a formula has the capacity of holding the odors so that as long as you have any of the perfume left it still retains its strength. The French use it also, in their finest "Bordeaux Rogue"—the red wine of Bordeaux, to hold the delicate bouquet in this rare vintage. But there are still other uses for ambergris; the medical profession utilizes it in the treatment of adynaemic fevers, chronic catarrh and nervous diseases. So those of you who think the whale has been relegated to the past, take heed. The whale constitutes at the present time, as he has in the past, one of the world's most valuable natural resources. Few animals have contributed more to mankind's pocket-book than the whale—the biggest brute that breathes.

It is hoped that the Mammalogists' Society will be successful in their efforts to preserve this mightiest of all creatures for posterity, for once the whale disappears from the face of the earth there will have passed the last of the great pre-historic monsters.

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For the Home Machinist

(*Continued from page* 817)

engaged in hand fitting, assembling, or metal removing operations.

There are five general types of chisels, all of which the average craftsman finds of use. The flat type of chisel serves for general purposes. Its cutting angle is about 60 degrees—the same angle can be used in working with the other four types. The face of this flat chisel is often bordered with round sides to prevent the ends breaking on hard steel. For brass and softer metals a chisel whose face is one inch wide is serviceable; for hard metals (as iron or steel) the cutting edge should be narrower.

The cape chisel is used for cutting grooves, such as hand-cut keyways. It can also be used to groove a surface before introducing the flat chisel. The round pointed grooving chisel fills in for chisel work wherever round corners are required. It serves chiefly for putting in oil ducts. The diamond point chisel cuts out corners, V-shaped grooves and irregularly outlined depressions. The side-cutting chisel cuts the sides of slots and recesses extending straight down into the work.

A scraper is generally necessary for fitting up parts. It is used mainly for truing flat and curved surfaces after they have been milled, planed or shaped.

In Fig. 4 you will see the triangular, hook and flat scrapers, which constitute the three usual forms.

Electrocuting Insects

(*Continued from page* 783)

red spiders had been an uncontrollable pest. After three fifteen-minute treatments the spiders disappeared, and the plants grew more luxuriantly.

More elaborate experiments were conducted subsequently with small fruits and vegetables. Strawberries taken fresh from the patch, washed and placed in a glass jar and then sealed, kept fresh for many weeks after being treated but three minutes. As a matter of fact, one can of strawberries and one of peaches both canned in clear water and treated for one minute, were in perfect condition the following summer.

Pea plants of the same age. The one at the right has been subjected to 10 five-minute treatments.

Further experiments are being carried on. Should they prove as successful as those already attempted, it may prove possible to rid plants of all the pests that beset them, including the dread boll weevil.

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Build This Band Saw of Laminated Wood

(*Continued from page* 823)

the hole previously bored, the loose flange is screwed up tight, the holes are aligned, drilled and bolted securely with quarter-inch carriage bolts three and a half inches long. No washers are necessary, but put the rounded side of the nut against the flange. The same procedure is adopted for the lower bearing, but after it is bolted, take apart and cut the middle piece in two, about a third of the distance above the center and above the cross bolts, as indicated by dotted lines in Fig. 2. Countersink a quarter-inch hole for a carriage bolt at right angles in the bottom and inside the shaft hole. Insert a five-inch bolt, reassemble and slip the whole into place, first drilling a hole through the base of the frame to accommodate the long bolt. To lower or raise this bearing it is merely necessary to loosen slightly the four flange bolts and tighten or loosen the adjusting bolt and screw the four bolts up tight. It will be necessary to keep your saw blade tight.

Drill an oiling hole 5/16" in diameter through the frame bearing at the top and below; drive a three-eighths piece of copper tubing almost to the shaft, letting it extend about an inch above the wood, stuff in a little waste to partly fill the tube, and oil with heavy oil. A grease cup may be used instead.

Three wheels are necessary, but the method of construction is the same, except that the driving wheel has no rim, unless you expect to use a flat belt. Secure three three-eighth inch floor flanges, have them bored to a driving fit on the shaft and face off the flange square with the hole and the outside. A hole is drilled in the hub of the flange

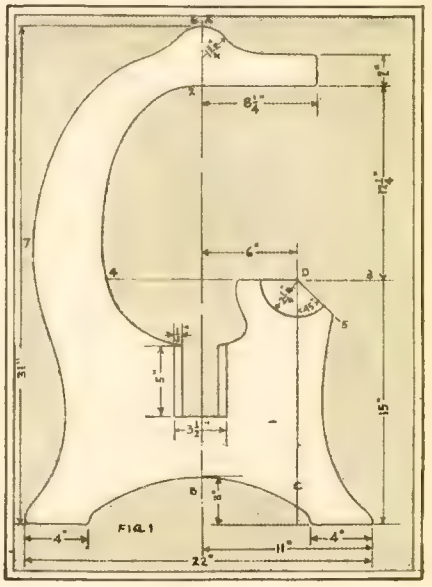
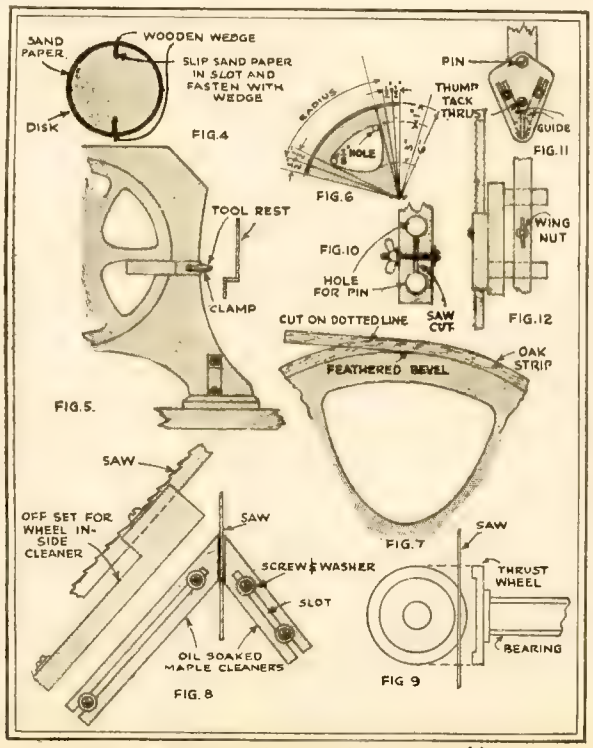


Fig. 1:—Outline of the frame, showing measurements.

and tapped for a set screw. Three pieces of fourteen gauge sheet iron two and a half inches square are bored to a tight fit on the shaft, and four screw holes are bored and countersunk.

The material saved from the center of the frame cut-out is used for the wheels. Mark off a twelve-inch circle on two pieces of ply wood and a six and a half inch circle on the other piece. Use some other scrap for the small wheel, instead of the third square of ply wood, which you will need for the table. Cut out the circles to the line on the jig saw. Bore a 11/16" in diameter hole in the center of each disk and assemble on the shaft with the flanges on the outside. Screw the flange to the disk first, then adjust the square piece to the disk and shaft, getting it as true as possible and screw it to the disk. Do this with all three wheels.

Turn a hardwood shaft to a tight fit, put the small wheel on and true up in the lathe, cut the groove for the belt (sewing machine belting), sand and give a good coat of HOT linseed oil, rubbing off the excess. Take from the lathe, slip it on



Showing various details of the assembly.

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the steel shaft and put into the lower bearing, belt to the motor and you are ready to true up the large wheels. A quarter-inch piece of strap iron is bent as in Fig. 5 and clamped to the frame with a C-clamp. This makes a very satisfactory tool rest. Now with the aid of your motor true up the large disk to an outside diameter of eleven and seven-eighths inches. While the disk is still revolving, mark two circles on the face with a pencil, one one inch from the outside, the other three and a half inches from the outside. These circles are the rim and hub margins. Remove the wheel from the shaft, remove the square metal from the inside, and mark the spokes with a template made as in

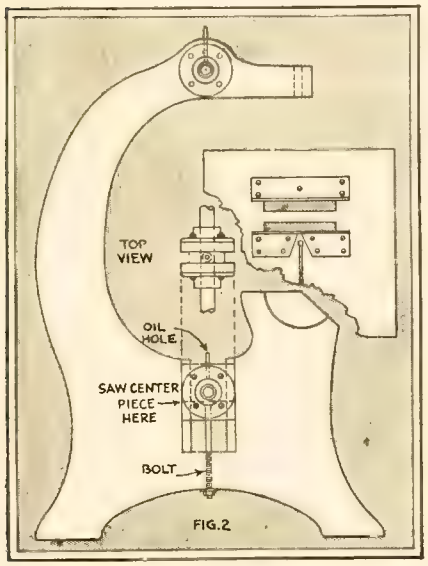

Fig. 2:—Details of bearings and method of oiling.

Fig. 6. Bore the holes in the disk at the junction of the spokes with the rim, and cut to the line with the jig saw. *Do not* remove the flange.

Rip a piece of straight grained oak one and one-eighth inch wide, one-eighth inch thick and thirty-nine inches long. Turn HOT water into the bath-tub and soak the strips for at least thirty minutes, and bend around the wheels using a C-clamp between each spoke. Let these dry thoroughly. Bevel to a feather edge one end of the oak strip, making the bevel at least three-quarters of an inch long. In glueing these strips to the wheels, start by clamping the bevel to the rim first and gradually work around the wheel, using plenty of clamps. At the end, the strip will extend over the bevel about an inch. See Fig. 7. Be sure and place a clamp over this joint. When the glue has set after standing overnight remove the clamps and cut the projecting edge flush with the outer edge of the wheel. Return to the lower bearing and true to twelve inches, sand, rounding off the spokes and all edges, give a good coat of HOT linseed oil and rub off the excess.

Drill a small hole through the upper shaft and drive in a pin, letting it extend at least one-eighth inch beyond each side of the shaft, cut a brass washer to fit the shaft and slip on. This keeps the upper wheel from running off.

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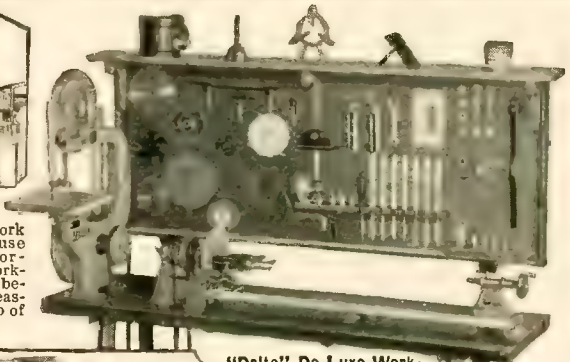

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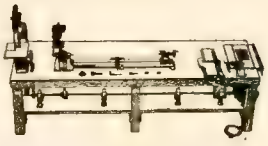

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Assemble the two wheels in their respective places, use a piece of linen tape for a "saw" and try it out! If your work has been accurate the wheels will run true and the "saw" will stay on the wheels.

Now for the table with its tilting device, guard, thrusts and cleaner.

The adjustable top thrust can be made in a number of ways, two of which are clearly shown in Fig. 9 and 10. The adjusting arm is made of three-quarter inch square maple, and by cutting a piece of the middle standard arm the maple will fit snugly, and with a couple of wing nuts it may be loosened or tightened for lowering or raising. The bottom thrust and cleaner are made as in Fig. 8. Soak the cleaner pieces in oil over night.

The guard is made of three-quarter inch material grooved to take the saw and secured to the frame with two wooden brackets.

The table is twelve inches square, or is can be made round, but if you make the table round first cut the grooves for the cut-off and the rip guide. The tilting metal disks are made of fourteen gauge cold rolled steel cut to the dimensions with a jig saw, bent at right angles and screwed to the two half-circle wood pieces. These are shown in position in Fig. 3. Be sure and get the center lined to coincide. Now clamp these in place on the frame with a C-clamp, find the center of the table and make a saw cut in it. Slip the wheels in place, put the saw on, tighten, and then slip the table on, getting it centered and square and then screw the bent edges of the tilting disks to it. Where the saw passes through the table it will be necessary to bevel the under side so the table will tilt without binding the saw. I found that by placing two layers of friction tape around both wheels the saw will ride much better. It will take a little time to line up the wheels in order to get the saw to ride properly.

The upper thrust is adjustable and is made as in Figs. 10, 11 and 12, or in any number of ways that can be devised to accomplish the same end. In case the saw is to be driven from a line shaft the drive wheel can be placed on the upper saw wheel shaft. The motor is fastened to an adjustable base with wing nuts so that in case the saw is broken and the lower wheel has to be raised the motor can be slipped a little closer to the saw. This feature is good, anyway, as it makes a convenient method of tightening the belt. The writer's saw travels about 600 R.P.M. and will saw six-inch material if taken slow. The writer has saws 82″ in circumference, ⅛″, 3/16″ and ¼″ in width and 24 gauge. They cost about $1.50 apiece.

He Can't Miss His Train

(*Continued from page* 806)

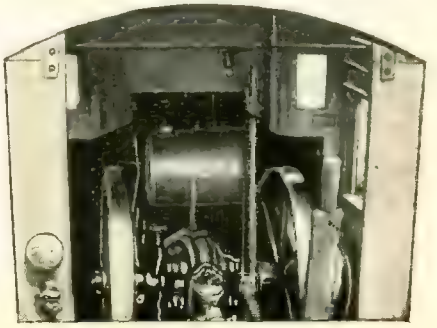
Fortunately, the trains are operated at speeds of not more than 15 miles per hour, which makes it possible to lighten up materially on the track.

Then there are round-tables for turning the locomotives around; sidings where they are shunted for loading and unloading of freight or passengers; a round house accommodating several locomotives; and a train shed alongside the house, near the highway, to pick up and discharge the travelers that come from far and wide to see them.

The rolling stock is unique in that it has the appearance of standard rolling equipment on a diminutive scale. Passenger coaches, freight cars, gondolas, flat cars and locomotives closely approximate the real thing in general appearance, on a greatly reduced scale, yet they are ingeniously designed to handle man-sized work. The passenger coaches are equipped with seats. Because of the reduced scale of the passenger coaches, the passengers must sit up with heads and shoulders above the roof. No harm is done here. The cars are mostly open at the top for carrying passengers. The box cars are arranged with drop sides, so that they may be filled with tools, produce and feed, for carrying on the work of the farm.

The locomotives, of which there are several, are of the steam type in appearance only. Actually, these locomotives are gasoline inspection cars, such as used by railroads, but in disguise. The gasoline inspection cars are employed ordinarily by section gangs and foremen, in place of the conventional hand-cars. Gage has built locomotive bodies on the gasoline inspection cars. He has fashioned the boiler of sheet iron. The front is a large garbage can cover. The headlight is an automobile headlight. Some wood and more sheet iron form the cab, steam dome and tender. A few more pieces of iron strip go to make the cow-catcher or pilot. A dinner bell serves as the locomotive bell. An automobile horn serves as the whistle from a utility rather than from a decorative standpoint. The engineer sits on a seat which represents the tender or coal car, and works the controls within the cab. To start the locomotive, however, one side of the cab is swung open and a crank inserted in the engine flywheel to start things going.

All in all, it is lots of fun. The tiny trains chug along at eight to fifteen miles an hour over the couple of miles of track, sometimes carrying freight and at other times carrying merry visitors who come from far and wide to enjoy this home-made railway.



View of the locomotive from the driver's seat.

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Glowworms' Light

(*Continued from page 786*)

light of the glowworms, and their curiosity spells their doom.

Going to investigate this fascinating glow, they find it a delusion and a snare, for they become caught on the sticky threads and the glowworm has another full meal. Once they touch one of the threads, they are lost beyond all hope. There they stick, despite violent struggles. The vibrations caused by the struggle attract the attention of the glowworm, which if hungry immediately winds up the hanging thread. If replete, the prey hangs in suspense until wanted.

In addition to obtaining the glowworms' food supply, its silken threads are also its body-guard. Exceedingly sensitive, the vibrations of sound caused by talking or other noises, are registered on them and the glowworm is warned of danger. It then, through some ingenious control method, is able either to dim the light or to cut it off entirely.

Endless Illumination

The organ which emits the glowworms' light is a gelatinous and semi-transparent structure at the posterior extremity of the larva, capable of great diversity of form. Attempts by entomologists to solve the intricate problem have been in vain. All they have learned of the organ is that it is green in color and does not give off heat waves, all its energy being expended on light rays.

It may be, when scientists learn whether the composition of the light is chemical or otherwise, and the manner of its control, that a new era of illumination as wonderful as electricity will have arrived. It is interesting to speculate on the possibilities of such a "cold" light.

This glowworm goes through four stages of life—that of the egg, the larva, the pupa and the fly. The average life of the larva is several months. When it reaches its full size it reabsorbes all the hanging threads, leaves its silken hammock and, hanging down, changes from a grub to a pupa. For a few days it hangs thus, still luminous but taking no food, and then out of it emerges a dainty, dark-winged fly, about twice as large as, and somewhat resembling a mosquito.

It shuns the daylight and so is seldom seen. It lays its eggs on the roof of the Grotto, the larvae are hatched, and the endless cycle of light goes on, providing endless illumination for the cave.

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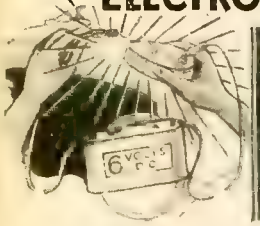

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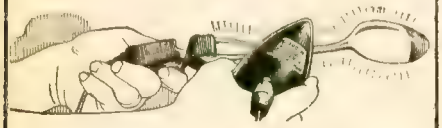

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A Book Table

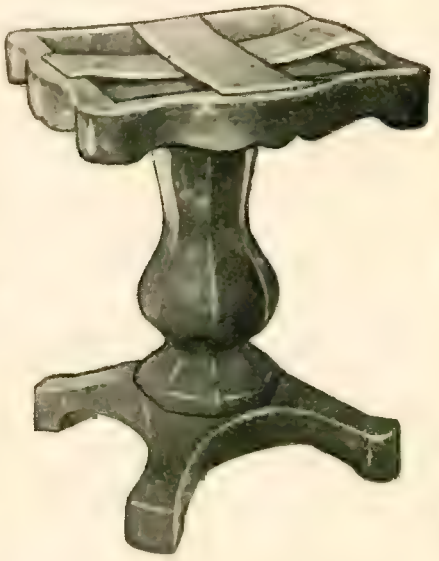
(*Continued from page* 805)

may be purchased from any fine cabinet shop or furniture repair place. In patching old curved surfaces, or veneering new wood, similar to the uprights mentioned, one should have sawed forms of the same shape for clamping. The photographs illustrate this clearly with regard to the uprights. The veneer should be thoroughly soaked and applied wet, or else it is likely to break on too sharp a curve.

After the veneer has been applied to both sides of these uprights, fit the cross pieces to them as indicated, and fasten the whole book-rack portion to the table top with screws from below. Fasten the upper top in place with dowels in the uprights.

For the reader who plans to build his own table from the bottom up, we suggest a simple design be adopted for the pedestal, or that one be turned as illustrated, instead of making it of hexagonal shape. He may make it revolve by mounting it on a large dowel in the center of the pedestal, or by purchasing an old revolving chair screw from a junk yard.

Whether rebuilt from the piano stool or constructed from start to finish by the craftsman, we feel sure that the results will more than justify the effort involved. A handrubbed natural varnish finish will put the final touches to a truly useful and ornamental article of furniture.



The piano stool as it appeared before work was begun.

New Ideas for the Owner

(*Continued from page* 812)

attached by any owner who is handy with tools or the work can be done very reasonably at a local garage.

The up-to-date driver who has noticed that new model cars are equipped with dual stop lights, so necessary in present-day traffic, places his auto on a par with the latest factory products by adding one of these devices himself. We have shown in our diagram a single wire connecting into the stoplight circuit is all that is required.

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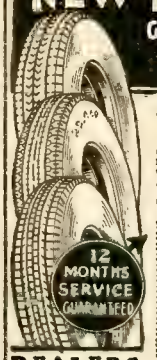

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33x4	2.95	1.15	28x5.25	2.95	1.35
34x4	3.50	1.15	30x5.25	2.95	1.35
32x4½	3.20	1.45	31x5.25	3.10	1.35
33x4½	3.20	1.45	30x5.77	3.20	1.40
34x4½	3.45	1.46	32x6.00	3.20	1.40
30x5	3.60	1.75	33x6.00	3.20	1.45
33x5	3.60	1.75	32x6.20	3.50	1.65
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Scientific Book Reviews

THE RADIO AMATEUR'S HANDBOOK, by A. Frederick Collins. New and Revised Edition (1930). Edited by G. C. B. Rowe, formerly Associate Editor of *Radio News*. 394 pages, 16 illustrations and 100 drawings. 8vo. Published by Thomas Y. Crowell Company, New York. Price $2.00.

The first thing about this book which strikes the eye before it is even opened is the claim made on the jacket by the author that he is the inventor of the wireless telephone. The present reviewer has been closely associated with all branches of radio communication for twenty years and thought he knew of all the important personalities who have contributed to the art in one form or another, but never has he heard of the name of A. Frederick Collins in connection with the wireless telephone. Still, that may be his ignorance; we live and learn.

The reviewer's next reaction, on looking over the book, is one of sympathy for friend Rowe. He certainly undertook a pretty thankless task when he agreed to edit this work, but it must be said that he has acquitted himself with honor. But it is a pity he did not allow the book to be buried decently instead of collaborating in its resurrection.

First published in 1922, this handbook has long outlived its period of useful existence. There are other works of reference available, notably the A.R.R.L. Handbook, which satisfy all requirements, and do so much better. The logical place for Chapter IV, "Electricity Simply Explained," is at the beginning of the book. Instead we find Chapter I devoted to "How to Begin Radio," which, incidentally, describes the slider tuners, crystal detectors and induction coil transmitters we used twenty years ago. Much of later chapters is also devoted to this and other similarly antiquated junk which is now to be found only in museums and the historical sections of radio exhibitions.

Later sections of the book, apparently the work of Rowe, give some useful up-to-date information, however, and at the end there is a glossary of terms, miscellaneous information, insurance requirements, and details of radio laws and regulations.

AUTOBIOGRAPHICAL AND OTHER WRITINGS, by Alan A. Campbell Swinton. 181 pages, 17 illustrations. Published by Longmans, Green & Co. Price 10 shillings and sixpence ($2.50).

On the flyleaf of this book appears the quotation: "Let us now praise famous men and our fathers that begat us." The author thereupon opens his work with many pages anent his ancestry, which he traces back to the twelfth century. None of it is of the slightest interest to anyone outside of his immediate family circle. The rest of the book is devoted to meandering and musty recollections of electrical and other scientific happenings and personalities during the past forty years, none of which appears to have much value.

The author's claim to fame is of somewhat dubious extent. He claims to have been the first to suggest the use of lead-covered electric wiring for use on board ship. He also possessed some reputation, during his younger days, as one of the earliest investigators in the field of cathode and X-rays. In 1911 he made the suggestion that television might be accomplished by the use of cathode rays at both the transmitting and receiving ends of the system, but never did any actual work on the idea. Of recent years he has written much concerning the impossibility of achieving television by present mechanical methods and advocating the use of cathode rays as the only possible solution to the problem in question. However, shortly before his death, which occurred in February, 1930, he witnessed a demonstration of the Baird system, and admitted in a letter to the London *Times* that Baird had succeeded by mechanical methods in producing recognizable images.

No doubt an interesting book for those who enjoy reading out-of-date reminiscences.

SCIENCE AND THE SCIENTIFIC MIND, by Leo E. Saidla and Warren E. Gibbs, published by McGraw-Hill Book Co., Inc., New York City. Pages XIII, 506. Price $3.00.

With each day a new theory is announced, another physical law is discovered, examination of photographic plates reveals a heretofore unseen star, a baffling problem is solved, novel devices are invented, intricate hypotheses advanced, new ologies, religions and systems of education come into being. The vast array of idea and thought material, which today seems to completely supersede what was basic yesterday, bewilders and perplexes the average individual.

Messrs. Saidla and Gibbs have collected a selected group of essays written by men, each high in his field. They have judiciously picked works, which, although specific in themselves, serve to answer various general questions. Are we discovering facts too quickly for us to absorb them? Is the old order being discarded before the new is understood? How practical are Scientists? What relation does Science bear to our History and our mode of living? Will Science supplant Religion? Is specialization a factor for good? are subject types which are directly or indirectly discussed.

The essays are not only educational and cultural but make very interesting reading. The introduction which precedes each article proves very helpful and provides sufficient background to permit the uninitiated to read the monographs with an understanding of the subject to be discussed. Eminent authorities who have contributed include Bertrand Russell, John Tyndall, Thomas Huxley, R. A. Millikan,

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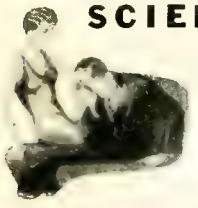

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Michael Pupin, J. S. Haldane and others. The compilers made a serious mistake in their selection of a name for the book. The heading Science and the Scientific Mind frightens you away—who would think that entertaining matter would be contained in a volume bearing such a grave and impressive title?

SEVEN IRON MEN, by Paul de Kruif, Published by Harcourt, Brace & Company, New York, Pages, XIV; 241. Price, $3.00.

Paul de Kruif has written a stirring biography of the Merritt clan. Graphically he has described their untiring efforts in pursuit of the elusive iron ore which they were so sure would some day be found in the Lake Superior Region. Chapter after chapter is devoted to the innumerable unsuccessful trips which various members of the family made into the wilds, dominated by that inborn urge to find iron, buoyed up through every disaster and hardship by their implicit confidence in their ultimate success.

Finally the Merritts announce the discovery of iron ore. The family own large blocks of land and commence mining operations. An eight million dollar offer is made for their vast holding and is scornfully rejected. Capital is interested, allied enterprises develop, railroads are built and steamship companies organized. The astute capitalists enter into partnership with these hardy pioneers. A handful of closely related men have opened up a wilderness to civilization and given a limitless supply of cheap iron ore to the nation. The financial panic of '93 and '94 follows and when business stability is again established the Merritts are stripped of all their holdings and the monied interests are in control.

Mr. de Kruif writes that it is an untoward tragedy that has left those responsible for the development of this section penniless. However, the writer cannot help feeling that it was inevitable. The Merritts were pioneers, not business men. Those very characteristics which spelled success for them as woodsmen and explorers caused their downfall when they attempted to deal with financial jugglers. Good lumbermen, they did not understand tricky business, and double dealing; did not even know that sharp practices existed, accepted every man's word as his bond, thought every one as honest as themselves.

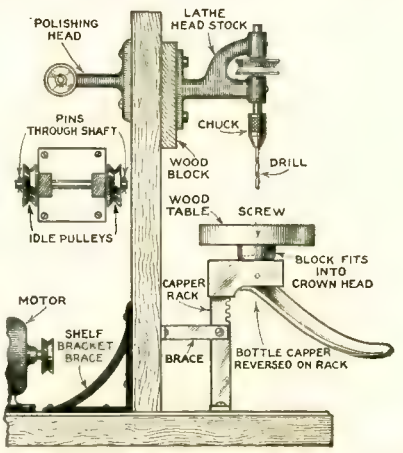
Reviewed books can be secured from the publishers or directly from our Service Department.

Drill Press from Bottle Capper

By Raymond B. Wailes

THE lever feed of a bottle-capper makes an ideal feeding mechanism for a drill press. Using two polishing heads or a lathe head stock and a polishing head with the converted bottle-capper, a drill press can be rigged up very easily. Certain brands of polishing heads and lathe heads are now selling for a dollar, thus making it possible to have a drill press for the home workshop for less than five dollars.

The illustration shows how the head stock or the polishing heads are mounted to an upright wood panel which in turn is fixed to the heavy wooden base board by means of a shelf bracket. The two pulleys on the polishing head are idlers, and are kept on the shaft by means of



pins thrust through holes drilled through the shaft. Stock pulleys are used. The drill head is a lathe headstock, or, if desired, a polishing head, with one end of its shaft threaded to take the chuck.

The feeding table is made of a bottle-capper with the movable head inverted upon the rack-upright. The lower part of the rack-upright is cut off, bent at right angles and drilled so that it can be fastened to the base by means of screws. An additional brace which gives extreme rigidity to the drill table is also added, and this is in the form of an L-shaped piece of metal, screwed to the panel and bolted to the rack.

The drilling table is a square or circle of wood in the center of which is mounted a wooden disc to slip into the crownhead of the capper. The soft rubber ring should be removed from the crownhead. A hole or two drilled through the crownhead will receive small screws which pass into the wooden disc of the drill table, thus holding the table securely to the feeding handle. In operation, the work is placed upon the table and the table fed by lifting upward on the capper handle.

. . Renovates Paint Brushes

BORE a hole in the end of the brush handle and suspend by a wire in a mixture consisting of one part of kerosene. The brush should not touch the bottom of the liquid container.

If the brush is not to be used soon, clean out with kerosene, gasoline or turpentine, and wash with soap or gold dust and warm water. Rinse soap out of brush and work lubricating oil into the bristles. Then wrap brush in paper until you need it.

—Frank Hall.

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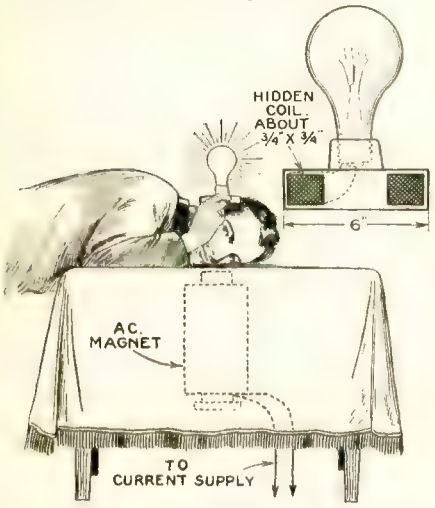
Spectacular Electrical Experiments

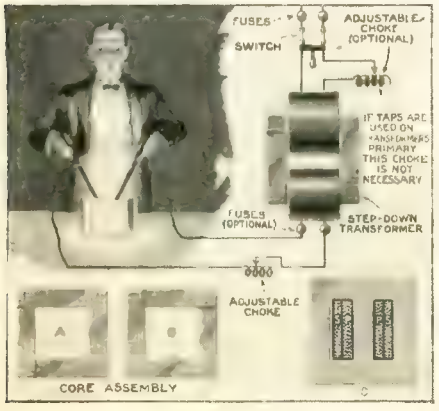
(*Continued from page 795*)

base of the lamp. This coil may comprise about 1400 turns of No. 30 B.C.C. magnet wire, wound in a slot ¾"×¾". This size will carry 1/10 of an ampere safely. The specifications which we have given you are such as to enable you to maintain a working current when the coils are eight to ten inches apart. If you should shorten this distance a higher voltage will be produced in the secondary and it is quite possible that whatever apparatus you have connected in series with this coil will be burned out. We suggest that you vary the number of coil layers in order to get the exact current that you require.



The mystic lamp isn't so mysterious after you have seen this diagram.

The amateur showman can give a striking demonstration by welding iron under water. With the use of a 1 K.W. welding transformer which delivers about 100 amperes at 10 volts, bars about ⅛th of an inch in diameter may be welded to flat strips of equivalent cross section. Clean the bars thoroughly of all oxide scale before attempting the experiment. The transformer is connected to the metal to be welded through rubber-covered copper cables, of the full current-carrying capacity of the wire used in the secondary coil of the transformer. Insert the rods in a jar of pure distilled water, and allow the ends to meet; they will become white hot and fuse together. When they have joined,

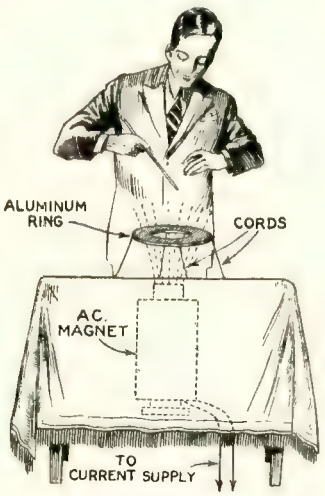


Connect the transformer as indicated and the rest is easy.

the operator who should wear smoked glasses and asbestos gloves to add to the atmosphere of mystery, should lift the welded rods from the water and display them to the audience.

The welding transformer of 1 K.W. rating is made as follows: The core is of laminated sheet iron, 15×8¼ inches over-all size. About five layers of insulating cloth or tape must be wrapped about each long leg. The primary winding consists of four layers of No. 10 B.S. gauge D.C.C. magnet wire wound over a length of 10 inches of the core leg. Insulating cloth is placed between the layers. The third and fourth layers may be tapped. Eleven and a half pounds of magnet wire yielding approximately 344 turns which is wound about one of the longer legs should prove sufficient.

The secondary, which is wound on the other long leg of the core, comprises 31 turns of No. 0 B. & S. gauge, D.C.C. wire or four No. 6 B. & S. gauge wire connected in parallel. Tape or impregnated fabric must be used as an insulator.



This trick can't fail to impress your audience —yet it's simple.

A more spectacular performance can be made if a 1 K.W. transformer, built to the following specifications, is used. The core measures 18×9½ inches over all. Cross-section of each leg is a square 2½×2½ inches. The iron will weigh about 75 pounds.

If connected to a 110-volt 60-cycle A.C. circuit, the primary coil must contain about 19 pounds of No. 6 B. & S. triple cotton-covered wire or an equal amount of No. 9, two strands of which are wound together and connected in parallel. The primary draws approximately 27.3 amperes and the coil is composed of 196 turns in three layers, each 12 inches long. (These dimensions apply to No. 6 wire.) In order to obtain 10 volts A. C. 60 cycle, the secondary requires about 20 pounds of copper wire (or bar) having a cross-section of 288,750 circular mills. This cross-section area can be supplied by winding on 11 No. 6's, 4 No. 1's, or 5 No. 2's (all B. & S. gauge) in parallel.

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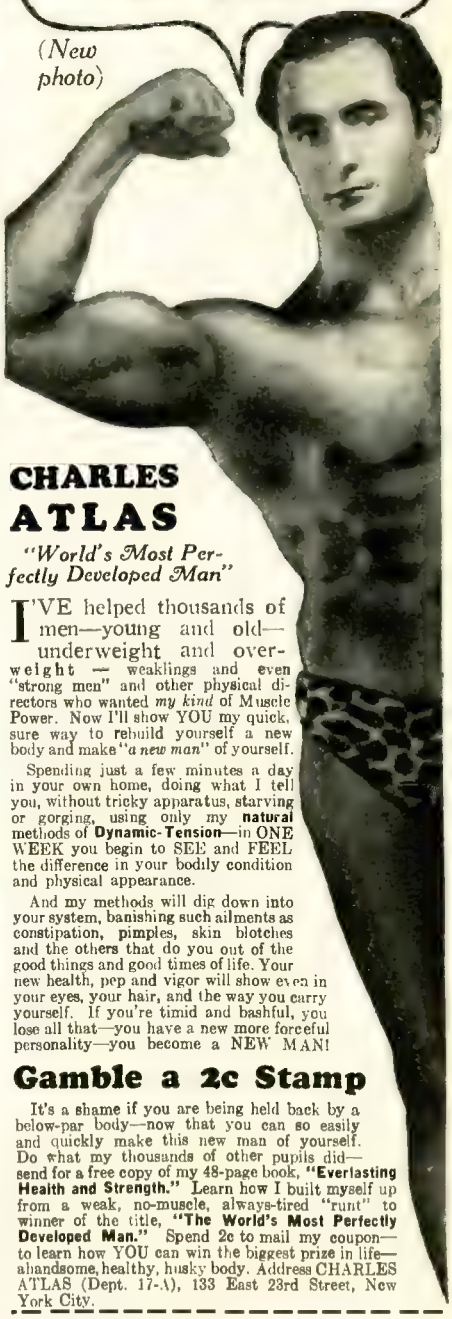

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How and Why Automobile Tires Wear Out

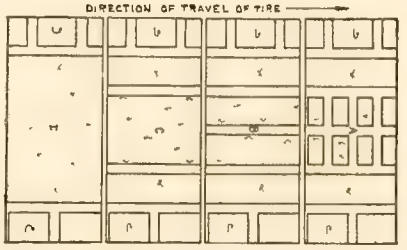
(*Continued from page 787*)

against and rolled along a heavy glass plate, through which the tread movement can be observed. A loading device permits the tire to be pressed against the plate glass and varying degrees of pressure can be controlled. The plate glass is ruled and etched in one inch squares as reference lines. By noting successive positions of any particular point on the tire with respect to a reference point on the glass the movement of the tread-rubber can be studied.

For accurate study these engineers coat the glass with some such liquid as soap solution or glycerin, and take photographs. For plotting their data a telescope is mounted about six feet away and observations are made through it.

"Observations of several tires showed that different parts of the tread have characteristic movements," Mr. Holt explained. "For instance, the central part of a tire usually shows straight-line movements opposite to the direction of travel of the tire, while other parts have a curved movement with a component of motion in the same direction as that in which the tire traveled."

For detailed study Engineers Holt and Cook use aluminum sheets coated with melted paraffin wax. The wax is sprinkled with grains of carborundum. Then, when a tire under load conditions is rolled over the plates the carborundum grains stick to the tire and trace their path on the waxed plate. These waxed plates are slipped between the tire and the plate glass.



The variously shaped marks on the tires illustrate how grit wears them.

With such equipment various tires have been tested at varying speeds from two miles an hour to thirty miles an hour. It was found that the scratches in the center of the tread increase in length as the tractive effort is increased, which is what might be expected. Mr. Holt explained that the circumferential movement of points in the intermediate portions of the tread are increased while circumferential movements of the outer portions (which are normally in the direction of travel) are decreased. The large movement, however, toward and away from the center does not change appreciably with a change in tractive effort.

In detail the government engineers found that the greatest tread movements occur under low pressures or high axle loads. All movements are more pronounced in balloon tires, which are inclined to wear faster and less uniformly than the treads of high-pressure tires.

"The common practice of cambering and toeing in of the front wheels of an automobile doubtless influences the tread wear. The results of these tests indicate that the movement of a tread may be affected by the direction of rotation, particularly in the case of a non-symmetrical design. It was noted that with some tires the tread movement is excessive at certain points, particularly at the ends or edges of non-skid buttons. From an observation of the way in which a button comes in contact with and leaves the ground, it would seem desirable to design the buttons so that the edges would be approximately parallel to the periphery of the area of the tire contact. This would tend to make the total area of the button come into contact quickly after once touching."

It was noted that it would be a good thing if motorists would occasionally change the direction of the rotation of their tires while in service. This would probably give a few more miles of wear.

"A considerable part of the tread wear," said Mr. Holt, "may be caused by the slipping of portions of the tread over the surface of the road in changing from the normal to the deflected condition and *vice versa*. This might be termed a scuffling action. It is recognized that a tire seldom rolls over a surface as smooth as a piece of glass or a waxed plate and that the tread movement on a rough surface may be different from that which takes place on a smooth surface. Nevertheless there will be the same tendency to slip on a rough surface as on a smooth one, and the tread movement on different surfaces will simply vary in degree, depending upon the amount of friction."

The investigators wanted it understood that factors other than scuffling were always responsible for tire and tread wear, such as poor breaking, bouncing, side skidding and various difficulties of that sort; but the study made had to do with treads under normal conditions and not with other factors which were already well understood.

"From general observation of tires in service it is thought that in most cases scuffling is the most important, or at least an important factor in producing wear," Mr. Holt stated.

"It was noted in several tires that there is a tendency for the tread to slip non-symmetrically even though the tread design is symmetrical. A close examination and adjustment of the testing apparatus indicates that this is the result of some nonuniformity in the tire itself."

The conclusions of these engineers indicate that tread movement is probably a fundamental cause of tire-tread wear and that when tires are made so as to prevent scuffling and twisting movements the tires on the average motor car will last longer and go farther.

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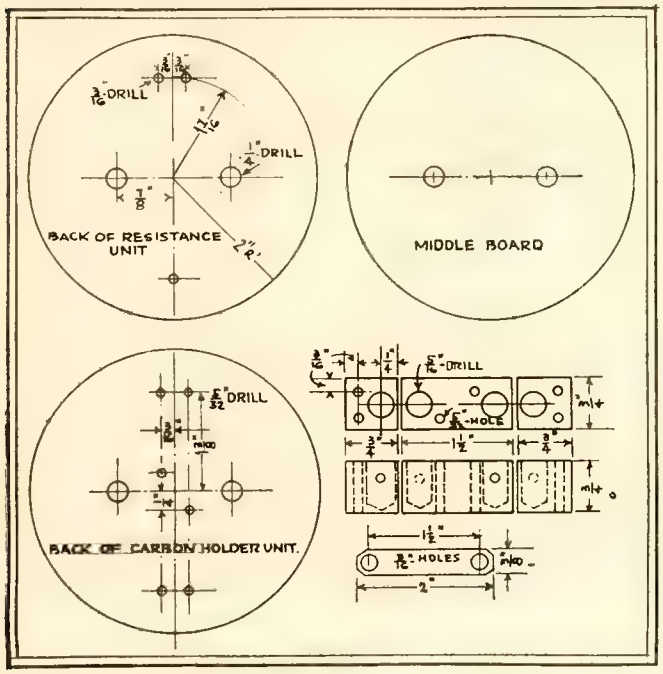
Make Your Own Sunlamp

(*Continued from page* 816)

Now test it out so it can be permanently mounted on the lamp. Carbons come in 12" lengths, so break them in half and put the pieces in the four holes. The unit illustrated was planned for 8 m.m. size. They should parallel each other, when tightened in the units. If they don't, put thin pieces of metal under the outer blocks until they line up properly at about 3/16" apart. Now take your resistance wire from a heater coil, hook one end to a long bolt, and the other to one end of the supply cord. The other end of the supply cord is hooked to the other bolt.

A lighter is necessary for the lamp. It is made by putting two short pieces of carbon into a length of rubber hose (so the whole can readily be held in the hand), and manipulated so the two carbons touch the ends of the two pairs of carbons projecting from the holder unit. It would be wise to make a little test block so the lamp can blow fuses without blowing the main fuse. Experiment with various lengths of resistance wire until you have the proper amount of coil to give a bright steady light, and yet not blow a ten ampere fuse. When it is working, tighten all bolts so they will be permanent.



Details of the resistance unit, middle board, and back of the carbon unit holder.

Slip the resistance unit in place over the long bolts (now getting short) and bolt down. On the bolt that does not go through the brass strip, put on two washers and another nut, to hold one end of the supply cord. The lamp is now practically complete. The cover over the resistance unit is not necessary, but it does add a lot to the appearance of the lamp, as well as protect the unit. Take the handle off the saucepan, and cut to fit around the band iron support. Punch three holes near the rim to fasten to the mixing bowl. For ventilation, punch a series of holes around the outside, one in the bottom of the pan, and put a rubber insulating bushing into it. Run asbestos-covered wire through the bushing, and connect as described. A plug is fastened to the other end.

A quickly made stand can be built from a length of fixture pipe screwed into an iron base supplied for making desk lamps. Before trying the lamp again, it would be wise to test with battery and bell for short circuits. You may have touched the bowl with a bolt.

You can paint the stand, but not the bowls. They get hot.

Make the band iron support illustrated in the drawings, bolting it on the bowl so it comes between the two large holes. This band iron support will permit any arrangement for supporting the lamp when finished. Now cut fiber washers to slip over the long bolts. You will need enough to keep the bolts of the unit clear of the aluminum bowl, or obviously you will short circuit the lamp. Now slip the unit through the mixing bowl so it is on the inside. Put more fiber insulators on the outside and run another nut on the bolts. This will tighten the unit into the mixing bowl. The reason for the large holes in the mixing bowl is to keep the bolts clear so as not to cause a short circuit.

Put more insulators over the bolts to keep the next piece of asbestos about ¾" away from the mixing bowl. This is the board which only has two holes in it. Coil the previously tested resistance unit to conserve space. Make an eye of the wire in each end, and bolt through the two holes close together on the outer edge of the remaining asbestos disk. On one bolt, slip the brass strip that goes to the long bolt. The other has double washers, so one end of the feed wire can be held between them. Into the single hole opposite the double holes put a bolt to help hold the resistance in place.

The Oracle

(*Continued from page* 820)

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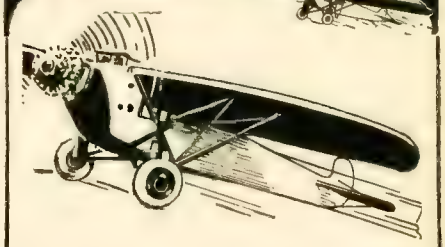

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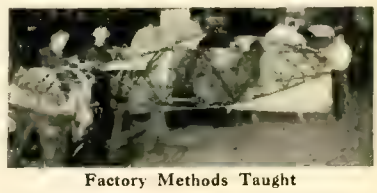

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Harnessing Ocean Temperatures

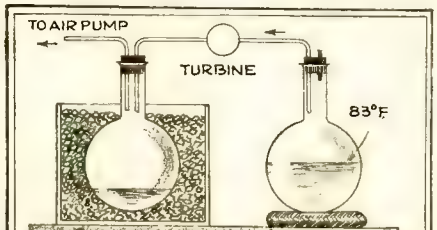
(*Continued from page 785*)

will boil can be varied considerably, depending upon the pressure of the atmosphere above the water. The figure of 212° F. is the boiling point of water only when the atmospheric pressure over the water is such that the barometer reads 30″, which is the standard reading at sea level during fine weather. If we climb a 7,000 foot mountain on an equally fine day we will find that at the summit the barometer will read approximately 22″, and water will boil there at a temperature of only 197° F.

The surface temperature of the sea in the tropics varies from 75° to 85° F., and does not vary all the year around more than four or five degrees at any given place. It is clear therefore that if the pressure of the air over the water is reduced sufficiently (i.e., if a vacuum pump is attached to the boiler) water at this temperature will boil and give off steam. This steam, of course, is so far below atmospheric pressure that the turbine also must be kept in a vacuum before the steam can do any useful work, i.e., drive the turbine.

At first glance it would appear that more power would be required to drive the air pump than would be generated by the turbo-electric machinery. It is at this point that we must study the function of the condenser.

The duty of a condenser is, as its name implies, to condense steam back again into water. It consists essentially of a boiler-like container through which flows a constant stream of cold water. Hot steam striking the cold water immediately condenses and falls to the bottom of the container as water, mingling with the cooling water.



Demonstrating the principle upon which Claude's work is based.

What is perhaps not generally known to non-technical readers is that, just as a given amount of water, converted into steam, takes up much more space, so steam, condensed into water, contracts into a smaller bulk, leaving a vacuum in the space which formerly contained the steam. In the Claude plant at Cuba the vacuum pump is used to start up the apparatus. Once the plant is running the necessary vacuum in the boiler is maintained by the condenser, from which a pipe runs to the boiler, as shown in the accompanying drawing. Cold water for the Claude condenser must necessarily be at a lower temperature than the surface water which feeds the boiler; hence the necessity for the mile long pipe which reaches far down into the ocean, and through which cold water is drawn up and allowed to flow through the cooling tubes of the condenser.

This long pipe, being perhaps the most spectacular part of the Claude apparatus, has received considerable publicity in the newspapers. It is made of corrugated sheet iron .078″ thick. It measures over six feet in diameter, and is 2,000 metres, or over a mile long. The pipe was built up on land, then launched, supported by steel floats. The first two attempts to perform the difficult operation of sinking the tube met with failure, but the third attempt succeeded. The distance of the end of the pipe from shore is about 1600 yards. The lower end of the pipe is at a depth of nearly 2000 feet below the surface. At this depth the temperature of the water is 50.9°.

Sweeping Ocean Currents

Careful surveys had, of course, to be made of the sea bottom before the pipe was sunk, the chief obstacle to be avoided being ocean currents which might sweep the pipe away. From the shore line out to a depth of 82 feet the pipe is buried in a trench, cemented over to protect it against the action of the waves, and the pipe is "lagged" or wrapped with heat-insulating material so that the cold water will not be heated on its journey upwards by the warmer water of the upper layer outside the pipe. The pipe was made of so large a diameter in order that the water in it should not be heated appreciably by friction against the sides.

One difficulty anticipated by Professor Claude was the formation of foam or large bubbles in the boiler and condenser due to the presence in the warm sea water of a considerable amount of air and other gases. Obviously, if the water in the boiler is aerated, as soon as the air pump gets to work to try and produce a vacuum the effect of its efforts will be impaired by the effervescence, in bubble form, of air from the water. Similarly, the vacuum in the condenser would be destroyed. This difficulty has been largely overcome by the installation, between the warm water intake and the boiler, and between the cold water intake and the condenser of purifiers, or de-gassing tanks.

There are several ways in which occluded or dissolved gas may be removed from water. The most effective mothod, which removes all gases, is to draw them out of the water by applying a moderate degree of vacuum. This involves the application of power, but since a very high degree of vacuum is unnecessary, not much power is required. It is this method which Prof. Claude has adopted.

We are now in a position to summarize the entire Claude process.

Warm surface water from the sea flows into a pit, whence it is raised to the de-gassing tank by means of a circulating pump. This water, after having been de-gassed, is fed to the boiler. Initially, an air pump is used to evacuate the air in the boiler so that steam is

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evaporated from the warm sea water; in other words, the water boils. But when evaporation takes place, the remaining body of water is cooled. It is therefore necessary, after a certain degree of cooling has taken place, to remove the water and replace it with fresh warm water. In practice this is a continuous process, warm water entering the boiler near the top, as allustrated in the drawing, and, after cooling by evaporation, leaving at the bottom. The ejected water is returned to the sea by any convenient route.

The steam evaporated from the warm water, after driving the turbine is, as we have already seen, condensed back into water, which water is allowed to run off into the sea. Cold water for the condenser is forced up gradually into a pit by deep sea pressure, and is drawn up from the pit by a circulating pump. After passing through a degassing tank and the condenser, the cold water is also allowed to run off into the sea.

The apparatus which Prof. Claude is using in Cuba was first tested out at Ougree, in Belgium, where, with a difference in temperature between the warm and cold waters of about 38° F., he succeeded in driving a 60 Kw. turbine at 6,000 R.P.M. In Cuba, with a temperature difference of only 18° F., approximately, he has succeeded in generating sufficient power to light forty 500 watt lamps, i.e., 20 Kw. The real source of energy is thus seen to be the temperature gradient between the warm and cold waters, and the efficiency of the plant increases as the square of the difference of temperature. The deeper the cold water pipe is sunk the colder is the water which can be drawn up from the ocean floor.

Measuring the temperature of water drawn up from the bottom of the ocean.

Although Professor Claude's experiments have to this extent proved the correctness of his theoretical premises, he admits that more power is at present required to run his auxiliary machinery, such as pumps, than he can obtain from his turbo-generator. In defense of this circumstance, however he stresses the fact that his equipment is in the nature of a laboratory setup, and that the various units are purposely out of proportion to enable him to carry out various experiments. He proposes to abandon the present plant as soon as he has completed his experiments, and build a new and much higher power plant which will, he says, definitely deliver a surplus of power on a scale sufficiently great to make the venture a commercial proposition. This projected plant, to be located at Santiago de Cuba, is expected to deliver a power of 25,000 Kw, at an installation cost of $60 per kilowatt.

The cold water exhaust from the condenser may possibly provide what may be termed a valuable byproduct, in that it might easily be used for refrigeration purposes to cool, by more or less natural means, tropical buildings in the vicinity of such a sea power plant. The occupants of such buildings might thus be visualized as "turning on the cold," just as we in northern climes turn on the steam heat in winter.

A 400-Ton Pipe!

During the course of a lecture before the American Society of Mechanical Engineers recently, Professor Claude gave the following interesting figures. The weight of the cold water pipe is 400 tons, and only one tenth of the water it brings to the surface is actually needed for cooling purposes; if the diameter of the pipe were to be reduced accordingly to one tenth of its present size, difficulties would be encountered owing to friction and heating of the water on its way up. The volume of both warm and cold water flowing into the boiler and condenser respectively is 200 litres, or approximately 52 gallons per second. "The loss of head in the pipe," said Professor Claude, "and the excess of density of the column of cold water for an output of one cubic metre per second and a speed of half a metre in the tube, caused in the pit a three-metre depression, which shows how small is the work to bring up cold water, although some arbiters assume that the tremendous work required to pump cold water condemns the process." This means that, on starting to pump from the cold water pit, the water level in the pit will fall nine feet and remain there, owing to deep sea pressure forcing cold water slowly up into it.

As is customary in such cases, Professor Caude's pioneer ideas have met with a considerable amount of adverse criticism. Indeed, as one British technical journal of high standing put it a few years ago: "If it were not for the unimpeachable standing of the promotors and their sponsors we would not for a moment give serious consideration to such a ridiculous idea." Professor Claude's caustic comment on his critics was to the effect that matter is much easier for an inventor to deal with than man! Referring to his difficulties, he said that "obstinacy is the best policy for an inventor."

Professor Claude is responsible for the foundation of several new industries. His investigations of rare gases, for example, resulted in the invention and perfection of the neon glow tube signs to which we are so accustomed. He also developed the use of acetone as a solvent for acetylene, processes for liquefying air and other gases, and for the fixation of nitrogen. His researches also resulted in the setting up of an important industry for the manufacture of synthetic ammonia. —*A. D.*

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IN RADIO NEWS *for January, 1931*

Zeh Bouck describes the South American flight of the "Good-will Pilot Radio" plane. This is the first instalment of three.

The operation of the Stenode Radiostat is explained in detail by Dr. James Robinson, its inventor.

A. Dinsdale "debunks" television in an interesting historical summary of the subject and an estimate of its future.

A three-page article, with about thirty pictures, describing the new midget receivers and discussing their place in the field.

The Air Cell—a presentation of something new in radio, a battery that provides "light socket operation" for those beyond the power lines. This battery breathes air and uses ordinary drinking water. It is employed with the new 2-volt tubes.

Carl Butman discusses the Federal Radio Licensing Requirements.

Don Bennett writes for the benefit of the newcomers in radio in telling how to build an amateur transmitter.

"Radio Rides the Airways"—an article on the communications system of the T. A. T.-Maddux lines.

"Europe Puts the Pentode to Work"—by L. Elden Smith.

The usual departments, including a new one, conducted by George E. Fleming, entitled, "In the Radio News Laboratory."

Answers to Scientific Problems and Puzzles on Page 822

Resonance in Tuning Forks

THAT a tuning fork picks up more sound energy through its box than it does from the sound that strikes its prongs can be demonstrated by removing the fork from its box and trying the experiment. In this case the tuning fork so removed must be retuned until in unison with the transmitting fork as the resonance box on which it is mounted has a very appreciable affect on the frequency of the fork. Under this condition the receiving fork will still fail to vibrate as vigorously when removed from its box as when properly mounted. In fact it is rather difficult to get it to vibrate at all unless mounted. We are thus forced to believe that the top of the resonance box receiving the sound energy imparts its energy to the stem of the fork and this in turn to the prongs. Is it not strange that the stem, which is jiggling up and down with a longitudinal motion, can set the prongs vibrating back and forth with a transverse motion?

Where Will the Air Go?

AIR that is pushed south is pushed from a latitude that is moving more slowly eastward with the earth's rotation than is the latitude toward which the air is blowing. On this account air that is moving toward the equator tends to lag behind the surface toward which it was originally pushed. That is, it drifts to the west.

These statements are true only for the northern hemisphere. In the southern hemisphere, air that is pushed south blows southeast, for it starts moving more rapidly eastward than is the ground to the south toward which it is directed. Thus it tends to gain on the region to the south and hence drift somewhat eastward.

Energy of Gasoline

A POUND of gasoline has about 20,250 B.T.U. of heat energy and each B.T.U. has an equivalent of 778 foot-lbs. of mechanical energy. Then since a gallon of gasoline weighs about 5.586 lbs. we find by multiplying these numbers together that a gallon of gasoline has 88,000,000 foot-lbs. of energy. Now it takes 2000 ft-lbs. to raise a ton one foot, so it takes 40,000 times as much to raise 40 tons a thousand feet or 80,000,000 foot-lbs. Thus a gallon of gasoline has not only enough energy to raise four ten-ton trucks to the top of a mountain a thousand feet high but has about 8,000,000 foot-lbs. to spare.

Effect of Static Electricity on Water

A CHARGED body, such as a rubber comb, when brought near a falling stream of water will draw the drops of water together by an action that is called "induction." According to the electron theory of this action the comb has an excess of electrons and hence is negatively charged. These electrons repell similar charges in each water drop to the side of the drop farthest from the comb. This leaves the nearer side of each drop positively charged and the farther side negatively charged. Any two drops that happen to be near each other will now have opposite charges on the surfaces closest together. Since opposite charges attract, the drops will be drawn together to form a more continuous stream.

The action is similar in some respects to that of a magnet on a string of tacks that cling to each other and to the magnet by "magnetic induction." If a "north" pole is used it will induce a "south" pole in the ends nearest the magnet and "north" poles in the ends farthest from the magnet. Thus the tacks become a chain of little magnets clinging to each other, the north pole of one to the south pole of its neighbor.

The Radiation Teeter-toter

IN this teeter-toter it will be noticed that the lower bulb is exposed to the sun's rays while the upper bulb is shielded by the screen. The lower bulb then gets warmer than the upper one, the air inside expands and forces the water in the joining tube to the other side. As a result the system rocks over into the alternate position and the oscillation in the reverse sense is soon repeated.

Water Pipe Elocution

WHEN water flowing in a pipe is suddenly stopped by the closing of a faucet its inertia tends to make it keep on going. The result is a violent jarring or hammering sound in the pipe. This hammering may continue for some time if some part of the faucet such as the washer is loose. In this case the washer alternately stops the flow of water and then releases it again. A section of pipe closed at its upper end, containing air is sometimes joined to the main pipe to absorb the force of the blows and thus reduce the hammering. Hot water pipes are more apt to produce this hammering effect than are cold water pipes, for a considerable quantity of air has been removed from the former by the heating process.

How Heavy Is Air?

AIR weighs about 0.08 lb. per cubic foot. A bungalow containing five rooms averaging $12 \times 12 \times 10'$ contains 7200 cubic feet. Hence the weight of the air in the bungalow would be 576 lbs. Could you lift it?

The Thrust of a Ladder

UNLESS the ladder stands vertically on the ground the total thrust is always greater than the weight of the ladder and its load. A smooth wall cannot support any appreciable weight of the ladder hence the ground takes practically all of this vertical force. But in addition to this force, the ground also has to stand the side push which tends to make the ladder slip. The resultant of these two forces must of necessity be greater than either one alone.

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Mechanical Ears

(*Continued from page 794*)

new science known as sound-ranging came into being, having as its objective the detection and location of the origin of sounds emanating from enemy artillery, submarines and aircraft.

All the armies engaged in the struggle camouflaged their artillery so as to make it invisible to enemy reconnoitering airplanes, or indistinguishable from the surrounding landscape, so that it became necessary to devise methods of locating the guns by the noise they made. This was achieved by placing a microphone at the small end of a megaphone or trumpet and moving the trumpet about until the sound was loudest, indicating that the microphone was pointed in the general direction of the offending guns. A second similar arrangement, placed some distance away along the front line trenches, gave a second directional indication, and the two bearings, plotted on a map, indicated by their intersection the approximate position of the enemy battery, which could then be shelled until it was silenced. Another method, which indicated the distance of the guns, consisted of using two microphones, one above ground and the other buried. The ground being a better transmitter of sound waves than the air, the buried microphone picked up the sound of a shot first, and by measuring the interval of time between the arrival of the sound at the buried and unburied microphones, the distance away of the battery could be calculated.

Similar methods were used to detect and locate submarines. Wires were run out to sea from the beach which terminated in a type of sound detector known as a hydrophone, which picked up the sounds of the submarine's engines and propellers. Hydrophones were also used on board ships. By making observations simultaneously from several widely separated points, the approximate position of the submarine could be determined by triangulation. Once roughly located, a surface craft,

An American listening post.

equipped with a hydrophone, would cruise round the approximate position until it arrived as nearly directly over the submarine as possible, when it would proceed to release depth charges, while dashing round in an ever-widening circle about the position. Towards the end of the war, very few German submarines escaped detection and destruction as a result of the perfection of these mechanical ears.

Forewarned is forearmed, and nobody realized this more accurately than those entrusted with the duty of defending London from air raids during the war. At first, news of a raid was flashed to the capital by observers stationed on the coast, but gradually there came into being the beginnings of a sound-ranging system for aircraft, which has since been developed to a high degree of efficiency by the various military powers. Many of these systems involve the use of a battery of microphones placed at the narrow ends of a

Listening post crew in action.

series of trumpets which can be directed to any part of the sky, but the weird-looking French device illustrated on page 794 operates purely mechanically. The four batteries of horns are so mounted that the operators can swing them, as a unit, to any point of the compass, and to any angle of elevation, so that the entire sky can be covered. Each opening of the honeycomb structures is the wide end of a horn, the narrow end of which is connected to a tube. All the tubes from each unit are coupled to large hoses and these, in turn, all terminate in two stethoscope arrangements which terminate at the ears of the two listening operators.

By means of devices like these, the faint sounds of approaching aircraft can be picked up long before they would otherwise be audible, and, further, these sounds can be made to tell their own story and divulge the location of the aircraft, their flying speed, height and distance away.

Butterfly Wings

(*Continued from page 796*)

and here they will remain firmly imbedded.

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In the January Issue of

Amazing Stories

THE PRINCE OF SPACE, by Jack Williamson. In the days of uncharted seas and sailing vessels, even piracy, now impossible, occasionally showed a benevolent streak. What such a career might prove to be in the air in future times, when more or less successful traffic between planets is established, we cannot foretell. But there are always two sides to every question—as our well-known writer proves in this beautifully written interplanetary novelette, complete in this issue.

VIA THE TIME ACCELERATOR, by Frank J. Bridge. While followers of Professor Goddard's theories and hopes are studying ways and means for the realization of rocket space travel, those scientists who believe with Einstein that time is a dimension are probably trying to find some manner of travel in time. If history and biography of past days contain so much that is fascinating, how much more absorbing would items of the future be? What our author dreams of for our earth a million years from now makes thrilling reading.

TANKS UNDER THE SEA, by Harl Vincent. Here is another Vincent story, done in his best manner. It might be worth while to think seriously about some of the theories propounded here in regard to such important items as atomic motors, radium, the miracle element, and the many kinds of rays, for our author is not only a writer of note—he knows his science, too.

THE DRUMS OF TAPAJOS, by Capt. S. P. Meek, U. S. A. (A Serial in three parts.) Part III. There seems no end to the amazing developments to be found in this wonderful tropical hidden city, and there certainly is no let-up in the excitement and thrill contained in this concluding instalment.

And other scientific fiction

Amazing Partnerships of Nature

(*Continued from page 788*)

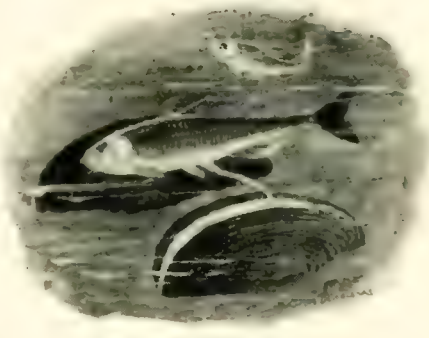
and seems to serve no other purpose.

Yet some naturalists, believing that the shark is quite capable of finding his own food, refuse to admit that the pilot fish's share in the partnership is exclusively food-finding, and think that he also performs some service as yet unobserved. Even if this turns out to be the case, the association must have proved highly satisfactory to both parties, for it has been observed and written about for centuries.

At first glance it would seem that there could be no way for a clam or oyster to cooperate with a fish—yet one of the most remarkable partnerships in Nature exists between the large mussels of lakes and streams and the fish called the Bitter Carp or Bitterling. Their association is in force only during the breeding season. At this time the female Bitterling develops a long orange-red egg-laying tube. It looks like a worm almost as long as she is. It s purpose?

In the bottom mud lies a river mussel, with its shell partly open to receive the microscopic food contained in the water. Suddenly the Bitterling swims over the mussel, inserts the red egg-laying tube between the valves of the shell, and expels probably hundreds of her minute eggs into the shellfish's gills. The mussel's service is to shelter these eggs until they hatch and the baby Bitterlings are large enough to swim out. The mussel plays nurse for about a month.

What is the most valuable service that the fish can render the mussel in return? She can, and does, aid in securing a wider distribution of the mussel's children. The shell-fish is fixed in the mud; the fish swims far and wide in the lake and river. What more natural



The clam who raises the fish's children.

than for the mussel to send out a stream of her embryos to attach themselves to the Bitterling's scales while she is busy with her egg-laying tube? To make the attachment easier for the baby mussels, Nature has provided these tiny shells with two sharp hooks. With them engaged in grappling the Bitterling's scales and fins, the mussel embryos can secure free transportation until they grow big enough to drop off and sink to a new mud bed more favorable for growth to maturity. This service rendered by Mrs. Bitterling balances the ledger, for she ferries the mussel children for about the same length of time that the Bitterling babies are being cuddled by Mrs. Mussel. That the latter appreciates the arrangement is seen in the fact that she refrains from closing her shell and snapping off Mrs. Bitterling's egg-tube while it is between her jaws.

The hermit crab would appear to have a legitimate ground for complaint against Mother Nature and her inveterate liking for experiments. Not content with making him lopsided, with one claw or pincer much larger than the other, she finally went away and left him incomplete. He has a hard, horny covering in front, but his soft hinder parts are left totally unprotected.

His life in the sea, among hungry crab-loving fishes, would therefore not be worth a moment's purchase did he not, from earliest infancy, seek out an empty spiral shell in which to hide his unarmored rear end. And as he grows he must constantly change to larger and larger shells.

Wise Hermit Crab!

You would naturally expect any creature who is forced to find new unoccupied lodgings of the right size every few months to be of very alert and enterprising mentality—and, as a matter of fact, naturalists who have observed hermit crabs in aquariums have a high estimate of their intelligence and resourcefulness.

This is nowhere better seen than in the clever arrangement which the hermit crabs have made with those strange animals that look like flowers—the sea-anemones.

The hermit was not satisfied with finding a mere empty shell for protection; he desired to further fortify himself by the addition of a valuable security against being eaten—a guarantee against becoming the victim of some hungry fish.

The crab noticed that the anemone is let severely alone. Practically no creature tries to make a meal of it. This immunity is partly due to the fact that this strange flower-like animal is provided with stinging threads which can be shot out and will penetrate the scales of small fish and kill them. Then again, larger fish, find the anemone undesirable because of a slimy, highly objectionable secretion from its skin.

Our clever hermit knows that a big fish's palate teeth are strong enough to crush his shell if the fish really wants a meal of crab—but he also knows that the fish will pass him up if it cannot secure him without getting a distasteful mouthful of anemone before it can crack his shell. So the crab joined forces with the anemone. Now, in exchange for his roofing service, the anemone gets, free carriage to better feeding grounds with a share of the crab's food.

There are many illustrations in botany of plants that have taken particular care to insure that ants shall feel at home on their stems and leaves. Why?

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Because the ants, usually provided with formidable jaws and stings, are deadly enemies to the leaf-eating caterpillars and vegetation-distroying insects which might threaten a plant's life by stripping it of its foliage.

In the case of the cow-horn orchid, which grows on trees in Central America, the plant has actually modified a part of its structure to make a permanent home for a protective colony of ant-police!

Orchids, having no roots in the soil, can only weather the hot, dry season by storing moisture in long pod-like structures called "pseudo-bulbs." In the cow-horn orchid, these bulbs are extended (a foot or two long) and hollow. This arrangement gives the requisite water-storage space in the walls and at the same time provides a long hollow gallery into which the ants can bring their nesting material and set up housekeeping.

Here, no matter how hard it rains in the wet season, the ants can remain dry and be ready to sally forth in force on the appearance of any caterpillar or other enemy of the plant and its foliage.

And here is the most amazing feature of the whole arrangement: at the base of each of the long pseudo-bulbs there is always a tiny doorway, for the entrance of the ant-police!

The hermit crab and his life-long partner, the sea anemone.

Make Synthetic Dyes at Home

(*Continued from page* 814)

by the amateur chemist in the preparation of indigo requires greater care than he has ordinarily to exercise to insure success. Treat aniline with a concentrated solution of monochloracetic acid until a solid mass is formed. Then heat this mass gently with sodium amide (prepared by passing absolutely dry ammonia gas over fused sodium metal which must be protected from the air) until the color base of indigo, indoxyl is formed. This undergoes rapid oxidation to form indigo.

Phenol, commonly known as carbolic acid, a powerful disinfectant, may readily be prepared from aniline, one of the great bases of a family of dyes. Place about 50 cubic centimeters of water in a large beaker and with constant stirring add 11 cubic centimeters of concentrated sulphuric acid; continue the stirring and add 10½ cubic centimeters of aniline. Place the beaker in a freezing solution and continue to stir until a white solid separates out. Then cool the solution to the freezing point and cautiously add 8 grams of powdered sodium nitrite. In order to keep the temperature at 0° C. or below, add more ice from time to time. In order to neutralize the excess of nitrous acid formed in this reaction, it is necessary to add 2 grams of urea. Continue the stirring operation for about 15 minutes. To distill over the phenol, allow the cold solution to drop slowly from a dropping funnel into a boiling solution of 200 cubic centimeters of water and 10 cubic centimeters of concentrated sulphuric acid in a 1000 cubic centimeters distilling flask. The mixture should be kept at the boiling point until about 250 cubic centimeters of the distillate has been collected. Diazobenzene sulphate is formed. The phenol may be recovered from the above distillate by saturating it with salt and recovering it with ether. Allow the solution to stand over fused sodium sulphate for a sufficient period, then allow the ether to evaporate and distil the phenol from a small flask. Phenol has a boiling point of 183° C. If the phenol obtained is colored redistil carefully.

Filtering sulphonic acid crystals which have been washed with water.

The preparation of the dye, fluorescein, requires considerable time and skill. Grind 22 grams of resorcinol with 15 grams of phthalic anhydride and heat on an oil bath to 180° C. As soon as the mass is thoroughly fused, 7 grams of powdered anhydrous zinc chloride are added with constant stirring. The temperature is gradually increased to 210° C., until the liquid has become a solid. The mass is then cooled, powdered and boiled with dilute hydrochloric acid to dissolve the zinc oxide first formed. Collect the fluorescein on filter paper and wash with water until the washings give no test for acid; then dry.

Fifteen grams of fluorescein should be added to 60 grams of alcohol and then 11 cubic centimeters of bromine added drop by drop. In this reaction the fluorescein first becomes soluble, and is then precipitated in the form of brick-red leaflets. The mixture should be allowed to stand for one hour after all the bromine has been added; then filter, and dry the residue at 110° C. By this reaction, eosin, the most important salt of fluorescein, is produced. This is the dye commonly used in red ink.

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Unscrambling the Ether

(*Continued from page 790*)

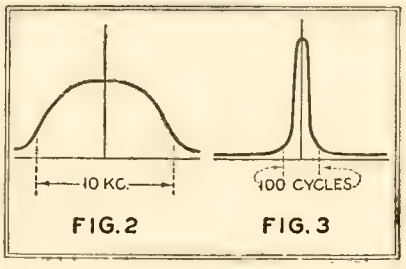


FIG. 2 FIG. 3

fected what is now known as the Robinson system of radio direction finding. This system permitted, for the first time, the installation of a direction finding receiver on the airplane itself, thus obviating the necessity for the planes to transmit while their bearings were taken by separated ground stations, which could only handle one plane at a time. All the Allies, including the United States, installed the system on their war planes.

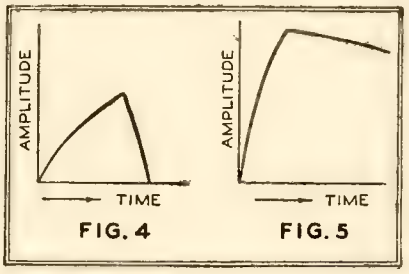
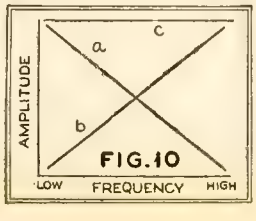


FIG. 4 FIG. 5

Dr. Robinson has several other important inventions to his credit, particularly in connection with radio direction-finding work, but I have not space to describe them here.

The end of the war found Dr. Robinson head of all wireless research and development at the British Air Ministry, and in this capacity he sat on many national and international committees which had to deal, amongst other things, with the allocation of wavelengths. It was in the course of this work that the overcrowded condition of the ether was driven home to him.

It was not until 1927, however, that he determined to tackle the overcrowding problem seriously, and see if some way out could not be found. Nearly all broadcasting stations impress speech currents on the carrier wave in such a manner that the amplitude (intensity) of the wave is varied. This is called amplitude modulation. An alternative method of modulating the carrier wave is to cause the speech currents to vary the frequency of oscillation of the carrier, i.e., slightly vary the wavelength. But the net result of both methods is to cause sidebands, for the proper undistorted reception of which a 10 Kc. separation between stations is necessary at all times.



Dr. Robinson reasoned that the frequency method of modulation appeared to offer the best solution to the problem of narrowing the frequency separation between stations, but to be successful, the frequency-wobble must in some way be confined to a few cycles only, say 5 or 10 cycles either side of the assigned frequency. Setting aside this intricate problem for the time being, however, he decided to attempt to apply these principles to reception from existing stations.

So far, in radio communication, the only characteristic of a quartz crystal which has received considerable attention is its ability to act as a very constant frequency oscillator. The fact that its resonance curve is exceedingly sharp has not been widely applied. What Dr. Robinson has done in the Stenode Radiostat, therefore, is to include in a more or less standard receiver a quartz crystal oscillator circuit, the sharp resonance curve of which acts as a sort of narrow bottle neck

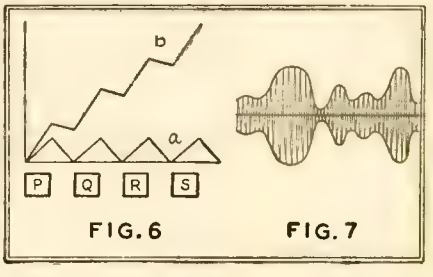


FIG. 6 FIG. 7

through which incoming signals, at radio frequency, must pass. The width of this bottle neck, in electrical terms, is, as already mentioned, not more than about 100 cycles. The circuit diagram of the crystal circuit is given in Fig. 1, from which it will be seen that the crystal is placed in one leg of a Wheatstone bridge circuit, the condenser C1 being adjusted to balance the capacity of the crystal in its holder.

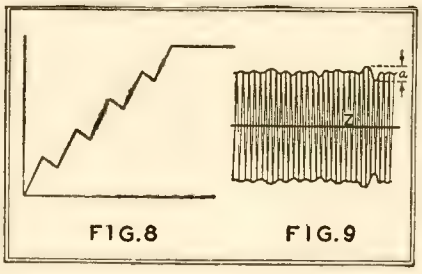


FIG. 8 FIG. 9

An immediate objection to the use of a quartz crystal resonator in a receiver is that its frequency cannot be varied, i. e., tuning from station to station cannot be effected. Some form of frequency changer is therefore necessary, and in the Stenode this takes the form of a superheterodyne. The inductance L in Fig 1 is coupled to the output circuit of the last intermediate stage, and the output of the crystal circuit goes to the grid of the second detector.

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Now we come to the part which radio men find hardest to understand. Why is it that such a highly selective receiver does not cut sidebands and produce very bad distortion?

To increase the selectivity of an ordinary receiver (i. e., narrow its resonance curve) it is necessary to reduce the damping of the circuit. The resonance curve of an ordinary broadcast receiver is as shown in Fig. 2, while that of a highly selective receiver of low damping is as shown in Fig. 3. If a momentary impulse is applied to a circuit having a resonance curve like Fig. 2, current will gradually build up to a maximum value as shown in Fig. 4. When the impulse ceases, the current will fall to zero practically instantly. In contrast to this, if an impulse is applied to a circuit of low damping, the current will build up more rapidly, and to a higher maximum, as shown in Fig. 5 and when the impulse ceases the current will fall very slowly. In the case of a circuit of zero damping, the current will persist, i. e., the circuit will oscillate.

Referring to Fig. 6, rapidly succeeding impulses, P, Q, R, S, will produce in a highly damped receiver a current response curve as shown at *a*, while the current response curve of a lightly damped receiver will be as shown at *b*. In dealing with ordinary highly damped broadcast receivers we are accustomed to visualizing the fluctuations of the incoming radio wave, due to modulation, which may be anything up to 100%, as shown in Fig. 7. The relation between Fig. 7 and curves *a* in Fig. 6 is that we never get away from the zero line. We cannot, because of the heavy damping.

Now, consider curve *b* in Fig. 6 for a moment. In a circuit containing zero damping and zero resistance, it is obvious that the current shown by curve *b* is on the way to building up to infinity. If we could flatten it out at a given current level—put a ceiling on it, as shown in Fig. 8, we should then change the appearance of the Fig. 7 curves to something like Fig. 9. What may be termed the "working portion" of the curve, which contains the modulation which we are interested in, is now reduced proportionately as indicated at *a*. In other words, we have demodulated the wave considerably, and the manner in which it was done was to boost up considerably the C. W. component of the wave, while keeping the modulation component at the same unamplified level. To extract from the carrier wave the intelligence which we desire, i. e., speech and music, all we have to do is to skim the cream off the milk, as it were. In other words we remove, by means of the detector tube, the working part *a* in Fig. 9, and in doing so we never approach the zero line Z.

That briefly, is the principle of the Stenode's operation. By the time the carrier wave reaches the second detector the degree of modulation is reduced to something like 10 to 15%. This process greatly attenuates the higher audio frequencies by comparison with the lower audio frequencies, so that the curve of the input current to the A.F. amplifier is similar to curve *a* in Fig. 10. By so designing the A.F. amplifier that it has a characteristic curve similar to curve *b*, all A.F. frequencies are amplified uniformly, so that the characteristic curve of the output current to the loud speaker is similar to curve *c*.

Television in Germany Today

(*Continued from page* 807)

receiving the official experimental broadcasts. *Telehor*, for instance, had a complete tele-cinema installation for a higher number of pictures, and the *Fernseh-A. G.*, a "tele-talkie" installation for the standard number of picture elements (1200), but a higher number of pictures (25 as against the normal 12½). The Telehor people now use a new synchronising method, similar to the phonic wheel synchroniser used by Baird and Jenkins, which eliminates any fluctuation of pictures, thus securing a satisfactory long-distance reception throughout the range of the transmitter. Another novelty of theirs which was demonstrated at the Exhibition is a new Image adjuster, which enables images to be adjusted to their proper phase by a swift and simple manipulation. It is significant of the cooperative spirit now prevailing in the field, that the same constructors should design their receivers with a view to the rapid exchange of discs when changing over reception from German to English television broadcasts.

Both English and German transmitters use a 30-hole disc, but the former uses vertical scanning with a picture ratio of 7 to 3, while the latter uses horizontal scanning with a picture ratio of 3 to 4. A change of receiver discs and an alteration of the position of the neon lamp is therefore essential.

Another exhibit of the *Telehor* Company was a screen receiver for projection on a frosted glass plate of images measuring 6×8 inches. Finally, the great improvement obtainable by an increase in the number of picture elements was illustrated by two receivers comprising 42-hole discs, instead of the standard number (30). These, of course, were connected by wire to the firm's own transmitter, any wireless broadcasts on this enlarged wave-band being, for the time being, out of the question.

Apart from their standard receivers, the *Fernseh—A. G.* also showed a mirror-drum receiver synchronised by the same method and with the same amount of energy as a Nipkow disc 12 inches in diameter. This receiver is to be used for small screen television. A standard Baird Televisor was likewise on show, but on account of differences in standards, it could not be demonstrated in actual operation. Kits of branded parts for television fans were shown by both firms. So far, however, no apparatus is actually on sale in Germany.

The Telefrunken Company did not demonstrate Dr. Karolus' apparatus at the 1930 exhibition.

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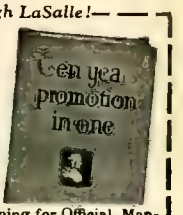

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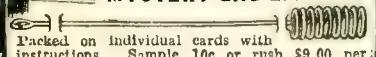

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Compact Bedroom Suite

(*Continued from page* 821)

this groove at the front cut a mortise ⅜ in. deep for the division clamp. (See also Fig. 10).

Groove the back edge of carcase top to a width of ⅜ in. and a depth of 5/16 in. for the back. Groove across the bottom board for the divisions (R) and stop 2¼ in. from the front edge as shown in Fig. 8. Vertically in line with these grooves work two more in the cupboard top (similar in size) for the divisions. Groove out the vertical divisions for the shelf (S) to a depth of 3/16 in. These divisions and shelf are the only interior fittings.

Work grooves on the inside edges of drawer rails (K) for the dustboards, and ⅜ in. tenons each end to fit corresponding mortises in the end clamps (I). Cut a mortise in the top drawer rail ⅜ in. deep for the tenon of the division clamp (O), the mortise to come vertically in line with the one already cut in the top. (See Fig. 10.)

Shape up and ebonize the blocks (A) and slot screw these to the carcase bottom. Fit the drawer runners next. Cut a tenon ⅜ in. long to enter drawer rail at front.

Groove the runner (M) ⅛ in. for the drawer division (N) as in Fig. 10, and also cut a tenon ⅜ in. long at front to fit the groove in the drawer rail (K). Guides are necessitated by the clamped carcase ends and should be pinned on.

Fit drawer runners above the cupboard top (Q). A ⅜ in. oak ply back, screwed in position after slipping the dustboards and divisions and shelf into their respective grooves, completes the finished carcase. The drawers are now to be considered.

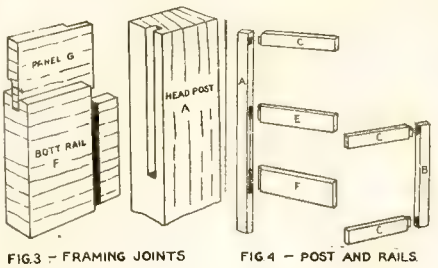

FIG.3 – FRAMING JOINTS FIG.4 – POST AND RAILS FIG.5 – ALTERNATIVE PANEL

Various constructional details of the bedstead, showing how joints are made.

DRAWERS

The drawer fronts should consist of quartered mild oak, care being taken to select dry timber. Groove the drawer fronts on the inside faces for the drawer bottoms, and fit slips to the sides. Rebate the bottoms on three edges to fit the fronts and slips, push in from the back, and slot-screw up into the backs to allow for shrinking. For fitting to the carcase, the drawer fronts and sides are allowed ⅛ in. wider than the finished sizes in Fig. 7. Small stops are fitted to the drawer rails behind the fronts.

The door construction is quite simple. Stiles and rails should be of quartered oak, whilst the panels of oak-faced plywood should show a quartered grain on the front. An alternative door section is given in Fig 11, introducing a solid panel.

Fig. 11 gives a general idea of the door construction.

Rebate the left hand meeting stile and work a bead and rebate on the right hand meeting stile. Haunch-tenon the rails into the stiles to form two frames. Clean up the oak-faced panels, glue and pin on top of the frame, afterwards filling the pin holes with dark wax stopping. The under facings (A9) are intended to be of white sycamore, whilst the top facings (A10) are of ebony. Glue and

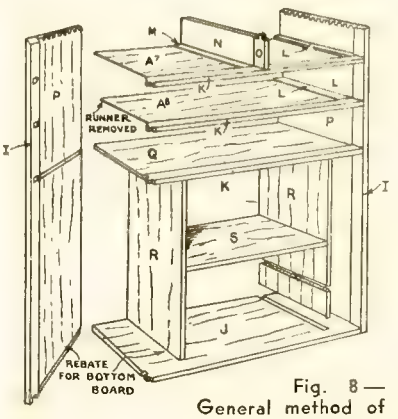

Fig. 8 — General method of construction of the tallboy cabinet.

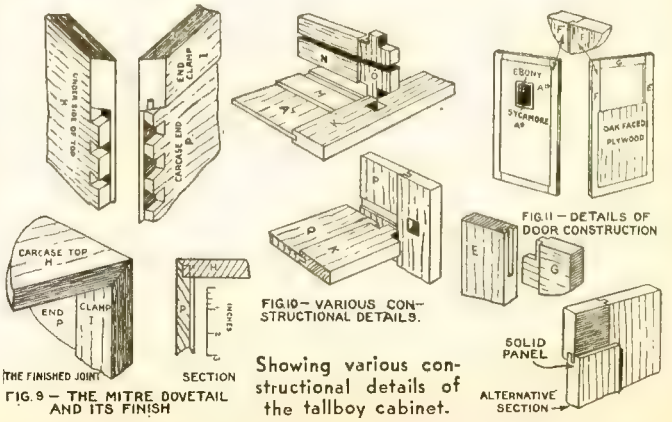

FIG.9 – THE MITRE DOVETAIL AND ITS FINISH

FIG.10 – VARIOUS CONSTRUCTIONAL DETAILS.

FIG.11 – DETAILS OF DOOR CONSTRUCTION

Showing various constructional details of the tallbody cabinet.

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pin to panels, using white polish, so as to keep the facings their natural color. A door stop is glued and pinned to the drawer rail (K). Clean down the job with fine No. 2 glasspaper for polishing to the blue oak shade.

The following brasswork may be used: Pair 2 in. brass butts with screws; two bullet catches for doors; one pair small barrel bolts for doors.

CUTTING LIST FOR BEDSTEAD AND TALLBOY

CUTTING LIST FOR BEDSTEAD

	Long Ft.	Long Ins.	Width Ins.	Thick Ins.
A—2 Head posts	4	0	2⅝	1½
B—2 Foot posts	2	0	2⅝	1½
C—3 Rails	4	4	2⅝	1½
D—1 Base	4	6	4	1⅜
E—1 Head rail	4	4	3½	1⅛
F—1 Head rail	4	4	5	1⅛
G—1 Panel	4	1½	10⅞	7/16
H—1 Foot panel	4	2	20	¼
I—1 Head panel	4	2	18	¼
J—4 Facings	0	7	5	⅛
K—4 Facings	0	5½	3½	⅛

All sizes are net; thus allowance must be made for planing, etc.

CUTTING LIST FOR TALLBOY

	Long Ft.	Long Ins.	Width Ins.	Thick Ins.
A—2 Blocks	1	7	3¾	1½
B—2 Drawer fronts	1	1⅞	4⅛	⅞
C—1 Drawer front	2	4½	5⅛	⅞
D—1 Drawer front	2	4½	6⅛	⅞
E—2 Door stiles	2	1¾	2⅝	⅞
F—2 Door stiles	2	1¾	3	⅞
G—4 Door rails	1	½	2⅝	⅞
H—1 Top	2	6	19	¾
I—2 End clamps	3	8¼	2¼	¾
J—1 Bottom	2	5⅝	18⅝	¾
K—3 Drawer rails	2	5¼	2¼	¾
L—4 Drawer runners	1	4¾	1½	¾
M—1 Mid runner	1	4¾	3	¾
N—1 Division	1	4¾	4¼	¾
O—1 Division clamp	0	4¾	2¼	¾
P—2 Outer ends	3	8¼	17½	9/16
Q—1 Cupboard top	2	5¼	16⅞	9/16
R—2 Divisions	2	2	16⅝	9/16
S—1 Shelf	1	6	16⅝	9/16
T—4 Drawer sides	1	5½	4⅛	7/16
U—2 Drawer sides	1	5½	5⅛	7/16
V—2 Drawer sides	1	5½	6⅛	7/16
W—2 Drawer backs	1	1⅞	3¼	7/16
X—1 Drawer back	2	4½	4¼	7/16
Y—1 Drawer back	1	¾	5¼	7/16
Z—2 Drawer bottoms	2	3⅜	17¾	5/16
A1—2 Drawer bottoms	3	8	17¾	5/16
A2—1 Carcase back	2	4½	29⅝	5/16
A3—1 Door stop	1	0	¾	¼
A4—6 Drawer guides	1	0	1	¼
A5—2 Door panels	1	10	10½	¼
A6—2 Drawer runners	1	4¾	1½	3/16
A9—2 Door facings	0	6¼	4¾	⅛
A10—2 Door facings	0	4⅞	3⅞	⅛

Sizes generally are net.

The Safety Valve

(*Continued from page 827*)

preservation it means this: Men tend naturally to become bald. An elderly man with plenty of hair is unnatural. Outside causes, such as hat bands against the head, do not cause baldness, though they may hasten the appearance of it. Likewise, hair-growth tonics can at best only check the course of natural evolution. New hair grows on bald areas only where the bald man is a kind of throwback from the path of evolution.

The above explanation may not be true, but it has the support of sufficient circumstantial evidence to make a baldy feel that he is the suffering advance agent, or the glorious primary manifestation, of the evolving new hairless era.

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(*Perhaps in the years to come man will lose his hair. Not only his hair but his teeth may ultimately disappear as a relic of the day when food was chewed. Then again perhaps in this evolutionary department, future man will dispose of his collars, ties, and hats and try to develop his hair again, as clothing is reduced in weight and garments assume a transparent condition. The fact remains that present man was not intended to be bald.*—EDITOR.)

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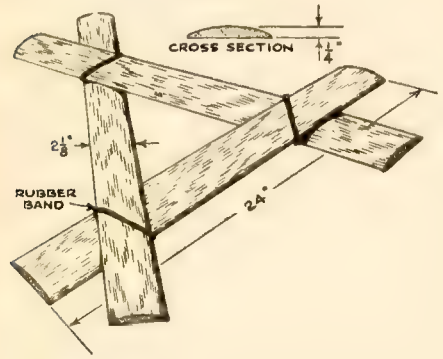
How to Make and Throw Boomerangs

(*Continued from page 791*)

that each has a leading or blunt edge and a trailing or tapered edge. Bear in mind that the part of the blade opposite the leading edge is always a trailing edge. The leading edge extends to the midpoint of each wood strip and then a trailing edge is cut along the same on the opposite half. This is so that the leading edge is always presented to the air. For best results, boomerangs have either a flat or hollow bottom, and the top of the blade is arched to present an air-foil surface, such as is found in an airplane wing.

After you have cut your wood to the size and shape desired, hold it with the curved side down over a gas or alcohol flame. As the wood is heated, bend both ends downward, raising the center, to form the dihedral angle. At the same time, twist the wrists so that your left hand moves away from your body and your right towards it, thus imparting a slight twist to the stick. When you look down at the blade you will see a slight right-hand twist, similar to that presented by a drill or corkscrew.

When your boomerang is assembled it will look like a four-bladed airplane propeller, except that its pitch or lengthwise twist is not so great, and that the blades are not flat, but have an upward bend from the midpoint to form dihedral angles. The smaller the dihedral, the higher the boomerang will fly. A large dihedral angle keeps the boomerang close to the ground. The sharper the twist, the smaller the arc in which the boomerang will fly. The less twist, the greater the circle which will be described by the boomerang.

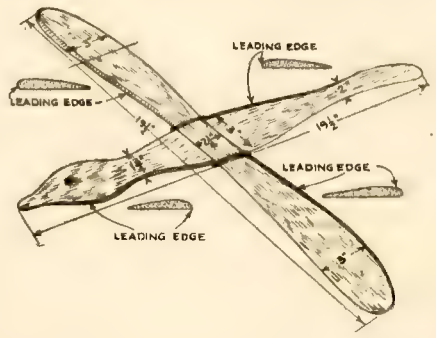


A correctly made triangular boomerang. Note the placement of the three arms.

Bend your blades either before or after they are whittled. Balsa wood will also retain its shape if the twisting is done over your steaming tea-kettle.

To fasten the parts of the boomerang together, hold the pieces crossed at the center. Slip a rubber band over one end of the top wing. Bring it down and diagonally under the cross member. Then turn up and over the top wing and across parallel to the edge of the lower wing. Then down again, cross the bottom wing diagonally. Slip the noose over the first piece, exactly where you started. Your boomerang is finished.

Boomerangs will work best when there is no wind. But should the day be windy, throw your boomerang into the wind, but not directly toward it. A good throwing position is to face the wind with the left foot forward. Toss the boomerang so that the direction of the throw will present substantially the same angle with the wind as the return. To hurl your boomerang with its flat side parallel to the ground you will have to give it a good spin, though not so much force is required to send it forward. Your boomerang thrown this way will generally curve upward and glide straight back or loop the loop. Boomerangs can best be thrown overhand. The blade is held either in the palm, between the first two fingers and the thumb or between the thumb and the



The cross boomerang, shaped like a bird.

forefinger, with the curved side inwards. Always move the arm straight from the shoulder, but you can toss in any direction between the hours of twelve and six o'clock through three o'clock.

All boomerangs are adaptations of the basic one which I have described in detail. I have included the two working drawings of the triangular and turkey boomerangs, so that you can readily see that they are merely more complex forms of the original two-piece cross boomerang. From the photographs you will observe that there is no end to the variety of shapes which a boomerang may assume. Just use your ingenuity to create new types. One of the most interesting boomerangs that I ever built I called the Spinning Wing. This is an ordinary straight piece of wood about one-quarter inch thick by 2½ feet long. The curve of the top surface is identical on both sides of the center, the bottom is flat. When it is thrown straight forward and a slight twist is given laterally to the stick, it buzzes around in the air and returns to your hands. Boomerangs can also be made with the ends so curved that a cross-section through the blade will show a perfect curve instead of an airfoil surface. This is particularly true of the multi-blade type, in which three straight sticks produce a six-spoke boomerang; a bolt through the center keeps the blades in place.

Again I want to tell you that you should not imagine that there are such things as set designs for constructing boomerangs. Try anything that you think will work. Remember that no two boomerangs will behave exactly alike. Each one will differ in some slight way from the next.

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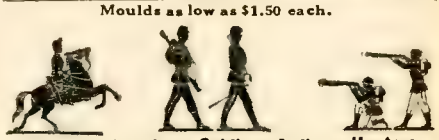

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INDEX TO ADVERTISERS

A

Alexander Hamilton Institute 834
Allied Radio Corp. . . . . Inside Front Cover
American Correspondence School of Law . . . 844
American School 861
American School of Aviation 850
American School of Photography 839
American Telephone & Telegraph Co. . . . 839
Anita Institute 844
Arkograph Pen Co. 840
Atlas, Charles 847
Atlas Indicator Works 861
Automatic Water Filter Co. . . . . Back Cover

B

Bastian Bros. Co. 842
Batenburg, P. J. F., Co. 844
Bernard & Heller 830
Bierbower, C. F. 834
Bliss Electrical School 834
Bogue, Benjamin N. 850
Brooks Appliance Co. 848
Buescher Band 832

C

Carter Prod. Corp. 858
Centre Publishing Co. 856
Chicago Gear Works 840
Chicago Salvage Stock Store 864
Classified Advertising 860
Coleman, Watson E. 832
Columbia "Tech" 854
Conn, C. G., Ltd. 842
Coyne Electrical School 773-775

D

D. C. Air Legion 836
Dayton School of Aviation 859
Deagan, J. C., Inc. 862
Delta Specialty Company 841
Detroit School of Lettering 837
Dobe, Engineer 843
Drake, Frederick J. & Co. 841
Dryer, Prof. J. A. 844

E

Evans, Victor J., & Co. 833
Excello Prod. Corp. 859

F

First Hawaiian Conservatory of Music 858
Fisher, Adam Mfg. Co. 830
Franklin Institute 842-851

G

Gaston Mfg. Co. 844
Gerstner, H. & Sons 854
Greene, W. T. 830

H

High Frequency Laboratories 835
Historical Coach Models, Inc. 837
Hoodwin, Chas. Co. 848

I

Ideal Aeroplane & Supply Co. 863
Institute of Applied Science 853
International Correspondence Schools . . . 855-863
International Mill & Timber Co. 852
International Typewriter Exchange 858
Inventors Finance Corp. 832

K

Keeley Institute 856
Keene Chemical Corp. 858
Kelsey Company 837
Kirk, W. J. 848

L

Laboratory Materials 846
Lacey & Lacey 832
Lachyrite Co. 838
Lamothe Corp. 846
Lancaster, Allwine & Rommel 830
Landon School 850
LaSalle Extension University . . . 839-848-857
Leonard, A. O. 848
Lincoln Airplane & Flying School 849

M

McGraw-Hill Book Co., Inc. 845
Marvel Mfg. Co. 844
Metal Arts Co. 850
Metal Cast Products 836
Midland Tire & Rubber Co. 856
Miller & Miller 830
Miniature Ship Models, Inc. 850
Muscle Power Company 838

N

National Academy of Music 836
National Electrical School 838
National Radio Institute 770-771
New Method Mfg. Co. 854-858

O

O'Brien, Clarence A. 831

P

Pan American Band Instrument and Case . . . 857
Plastex Industries 840
Polachek, Z. H. 832
Porter Chemical Co. 840

R

R. C. A. Institute 828-829
Radio International Guild 844
Radio & Television Institute 769
Randolph & Co. 830
Roll-O Specialty Co. 841
Royal Sales Co. 846

S

Schiercke, H. C. 850
Slavin Institute 856
Spors Importing Co. 837
Stahl's Outdoor Enterprise Co. 846
Strongfort Institute 836
Superior Match Pants 852

T

Tamblyn, F. W. 834
Tarbell System, Inc. 846
Teleplex Co. 855
Thaxley D., Co. 842
Twentieth Century Mail Order Corp. 840

V

Van Nostrand, D. 832-850

W

Wagner, George Steve 838
Walker Turner Co., Inc. 852

Y

York Tire & Rubber Co. 844

(While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.)

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Answers and Prize Awards in October Puzzle Contest

First Prize, of $10, is awarded to:
Earle Mountain, 255 Brow Street, East Providence, R. I.

Second Prize, of $5, is awarded to:
Francis Fechner, 32 West Broadway, Salt Lake City, Utah

The ten prizes, of one dollar each, are awarded to the following:

Edward Schnitker, 517 South Ave., Toledo, O.

Howard Cadwallader, 133 Mayland St., Germantown, Philadelphia, Pa.

Wm. Wegscheider, 1268 Goodrich Ave., St. Paul, Minn.

Dr. H. S. Herman, 1458 Madison Ave., N. Y. City.

P. M. Ginnings, 414 Northridge St., Greensboro, N. C.

Edwin R. Shaw, 506 Lyon St., N. E., Grand Rapids, Mich.

W. C. Anderson, c/o Carrier 36, Waco, Texas.

Paul E. Grof, c/o Penn. Dept. of Highways, Hollidaysburg, Pa.

Vincent Fernandez, 6119 Selma Ave., Hollywood, Cal.

O. Thoms, 4743 West Lake St., Chicago, Ill.

"Heard on Main Street"

PERKINS first asked $15 for his watch, and Jones countered with an offer of $8. Then Perkins offered to knock off one-third, coming down to $10. Jones increased his offer by 12½ per cent., to $9 which left them one dollar apart.

Solving the problem algebraically, we call Perkins' first asking price, X dollars, and Jones' first offer X minus 7 dollars.

Perkins came down to 2/3 X dollars, and Jones went up to 9/8 times X minus 7 dollars. At this time there existed one dollar difference, so we have the equation:

2/3 X minus 9/8 (X — 7) equals 1; and X equals $15

Regarding the time of their meeting, it can be proved that it must have been 36 minutes past 9 o'clock, a.m.

Let us call the elapsed time from "midnight until now" X, and this will also represent the hour of the morning when Perkins made his statement. Then 24 minus X will represent the time from "now until midnight."

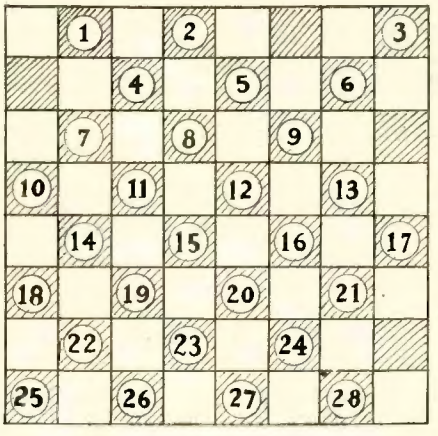
Therefore, one-quarter of X plus one-half of (24 minus X) equals X.

Solving proves X to be 9 and 3/5 hours.

"Scotch Solitaire"

TWENTY-SEVEN men are removed from the board in continuous jumps as follows:

8 jumps over 5 and 6; 1 jumps 4; 13 jumps 9; 2 jumps 5; 20 jumps 16; 28 jumps 24; 17 jumps 21; 13 is jumped by checker on unnumbered square which



lands on 16; 10 jumps 7; 11 jumps 8; 12 jumps 9; 18 jumps 14; 19 jumps 15; 20 jumps 16; 25 jumps 22; 26 jumps 23; 27 jumps 24. We now have ten checkers on the board and the one numbered 3 can remove the other nine and land on 22. The sequence is susceptible of variation.

The Backwoods of Russia

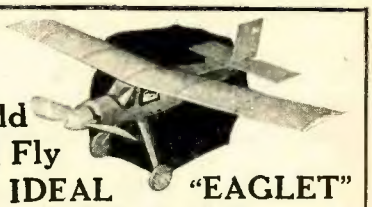
(*Continued from page 793*)

fashion, and covered with birch bark; then another layer of poles is added, and so on. It is worth remarking here that in many other respects, such as in features, religious equipment, and dress the Oyrots remind one of the hunting Indians of northwest North America.

Each Oyrot group has four villages, and moves every three months, transporting their houses, and making the complete round each year.

The religion of the Oyrots is known as Shamanism, widely practiced in the Siberian area, with a local variation known as Burkhanism, (or Birchanism). Good and evil deities are recognized—their names are Ulgan and Erlik respectively—and dealings with them are carried on through Shaman priests, whose methods and ceremonial devices are much like those of Indian medicine men. For the wealthier adherents the favorite religious prescription of the priests is horse sacrifice, which consists in slaughtering the animal—or several of them—in an insanely brutish way and then, for the poorer Oyrots, the priests recommend sacrifices of milk, fruit, or butter.

Within the past few years the power of the priests has begun to wane. The biggest factor in their decreased importance was the introduction of electric lights in Ulala, the Oyrot capital. Wise old men at first poopoohed the story of the mysterious new lighting method, but curiosity provoked investigation, and soon visitors came hurrying back from Ulala to demand that the Shaman priests match the magic of the new government. That was an order a trifle too large for the priests.



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The Most Interesting Evening I Ever Spent

UP TILL 9 o'clock the party was a complete flop. Nobody seemed to be able to get things going. Then Tom walked in. Tom's a live wire, if there ever was one.

He said he'd heard about a one man show anyone could perform with the help of a book he knew about. He had sent for that book, and said he was going to put on the show.

We thought he was joking, and laughed at him, but he sat us all down in the living room, got out a pack of old playing cards, and started to do things that made our eyes pop out of our heads.

For over 2 hours he made those playing cards almost talk. What he could do with those cards just didn't seem human. After it was all over, the gang all crowded around shaking his hand, and patting him on the back. The girls all said, "Oh, Tom! You're wonderful!" It was by far the most interesting evening I had ever spent.

I asked him how he learned it all, for I knew he didn't know a single thing about card tricks a week before. For answer he pulled out a shiny new quarter, and said that one just like it had taught him every trick he had showed us.

And it was a fact! Tom had simply enclosed a quarter with the coupon below, and gotten Walter Gibson's Famous Book of Popular Card Tricks by return mail. You, too, can entertain yourself and your friends with the 101 card tricks it teaches. No sleight of hand is necessary—no hard work to learn. Simply read the book carefully and you can do every trick in it.

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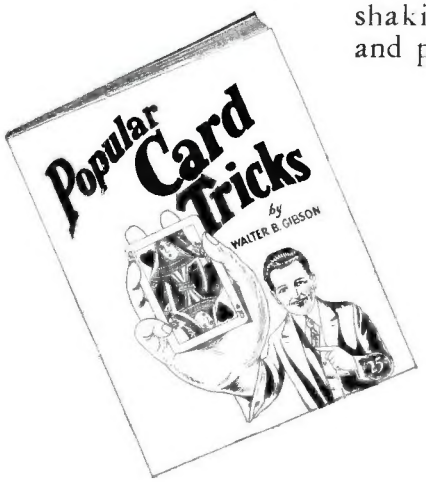

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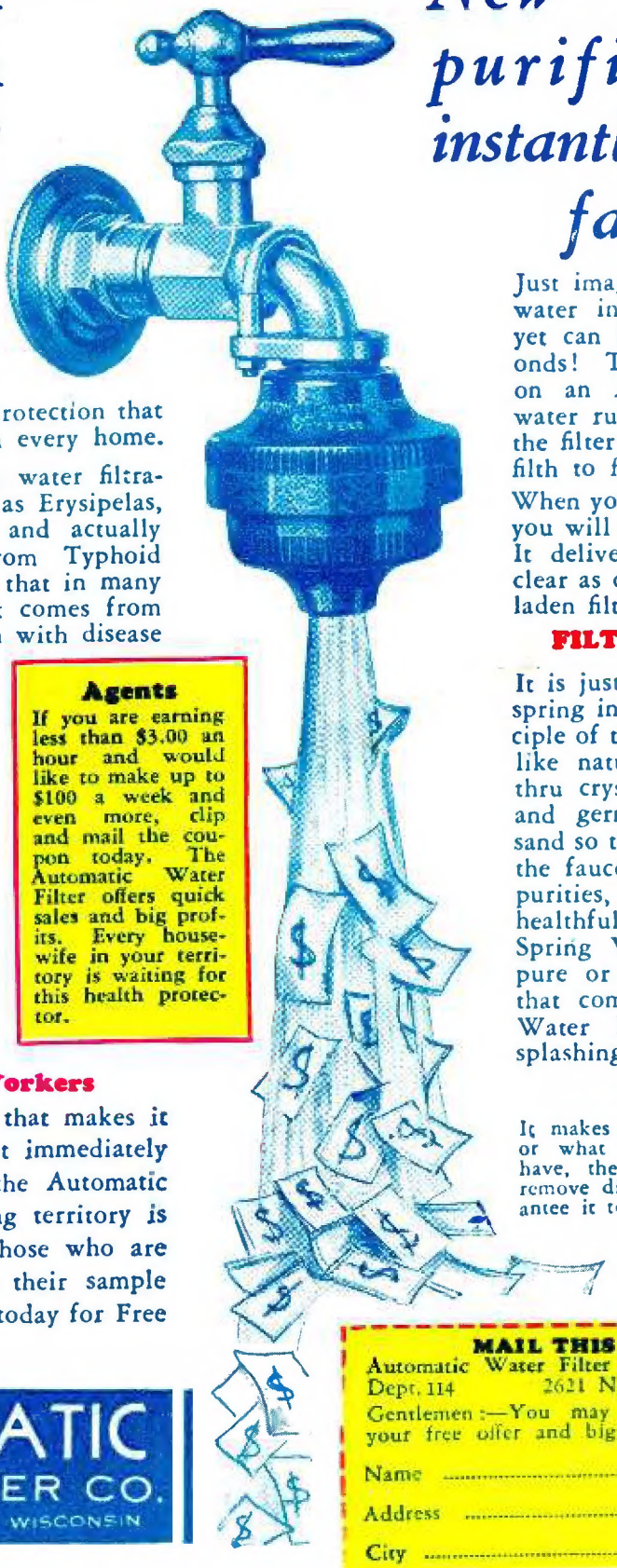

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